



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

**THE COMBINATORIAL RETENTION AUCTION MECHANISM
(CRAM): INTEGRATING MONETARY AND NON-MONETARY
REENLISTMENT INCENTIVES**

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Abstract

This research addresses the potential retention and cost impacts of providing an optimal individualized portfolio of non-monetary and monetary incentives to influence reenlistment and retention behavior in enlisted Sailors. Specifically, it explores three mechanisms for administering enlisted retention: a purely monetary auction, a Universal Incentive Package (UIP) auction, and the Combinatorial Retention Auction Mechanism (CRAM).

In this text, the mechanisms are simulated, their outcomes compared and their respective strengths and weaknesses explored. The findings of this research confirm that CRAM clearly outperformed the monetary and UIP auctions. Cost savings to the Navy ranged from 25 to 80% over monetary incentives alone.

Additionally, this research addresses the force-diversifying potential of CRAM. It is shown, for the sample used, that offering certain non-monetary incentives changed the demographic mix of Sailors retained.

By allowing Sailors to choose only those benefits which suit them, the Navy can eliminate the waste associated with unwanted benefits, while at the same time empowering its members.

Keywords: combinatorial auction, non-monetary retention incentives, personnel retention, force shaping.

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List of Abbreviations and Acronyms

AC	Air Traffic Controller (Navy rating)
ACOL	Annualized Cost of Leaving
AFQT	Armed Forces Qualification Test
BAH	Basic Allowance for Housing
BAS	Basic Allowance for Subsistence
CBO	Congressional Budget Office
CIWS	Close-in Weapon System
CLC	Corporate Leadership Council
CNP	Chief of Naval Personnel
CRAM	Combinatorial Retention Auction Mechanism
DOD	Department of Defense
DON	Department of the Navy
EAOS	End of Active Obligated Service
FC	Fire Controlman (Navy rating)
GAO	Government Accountability Office
MOE	Measure of Effectiveness
NEC	Navy Enlisted Classification
NMI	Non-monetary incentive
NPC	Navy Personnel Command
OPTEMPO	Operational Tempo (how often a unit deploys)
PERSTEMPO	Personnel Tempo (how often an individual is deployed)
QOL	Quality of Life
QOS	Quality of Service

RBS	Royal Bank of Scotland
SRB	Selective Reenlistment Bonus
SWO	Surface Warfare Officer
TAD	Temporary Additional Duty
UIP	Universal Incentive Package
USMC	United States Marine Corps
VP(AP)	Varying Percentile Cost (all positive)
VP(HP)	Varying Percentile Cost (high positive)
WTA	Willingness to Accept
WTP	Willingness to Pay

I. Introduction

A. Purpose

This research addresses the potential retention and cost impacts of providing an optimal individualized portfolio of non-monetary and monetary incentives to influence reenlistment and retention behavior in both enlisted Sailors (air traffic controller and fire controlmen) and Officers (Surface Warfare Officers).

Although the idea of flexible benefits packages has been present in corporate America since the early sixties and gained popularity by the early eighties (Tremblay, Sire & Pelchat, 1998), it is a very recent idea to the US Navy. The military benefits package has long been characterized by a diverse set of benefits designed to include several elements that contribute to military readiness or to the service members' quality of life. It also provides numerous —benefits” that many service members do not need, desire, or use. To paraphrase the Chief of Naval Personnel (CNP), VADM Mark E. Ferguson's comment at the 2008 Navy Workforce Research Conference: Why are we giving childcare benefits to an 18-year-old single Sailor with no dependents? (2008).

By allowing Sailors to choose only those benefits they value more than the cost to provide, the Navy can eliminate the waste associated with unwanted or undervalued benefits, while at the same time empowering its members by giving them a voice in their compensation structures.

The Navy attempts to obtain desired end-strength by balancing personnel losses with accessions and retention. The retention of qualified experienced Sailors has historically been considered a more cost-effective option than recruiting and training new accessions to replace those losses—especially those —in critical skill specialties with high training costs or demonstrated retention shortfalls” (OUSD(P&R), 2005b, p. 610).

1. Enlisted Community

The Selective Reenlistment Bonus (SRB):

provides a bonus to enlisted personnel who reenlist in a skill characterized by inadequate manning, low retention, and high replacement costs payable to an individual with between twenty-one months and sixteen years active service. Payment is based on monthly basic pay times a specified award level [...] times the number of additional years of obligated service. (DoN, 2008, p. 85)

According to the US Government Accountability Office (GAO), the Department of Defense's budget for the Selective Reenlistment Bonus Program has more than tripled [...], from \$235 million in fiscal year 1997 to an estimated \$789 million in fiscal year 2002" (GAO, 2002b, p. 5). The Navy's portion of the SRB funds was estimated at \$323 million in 2007, \$358 million in 2008, and \$359 million in 2009 (DoN, 2008, p. 85). According to a GAO study in 2005, "[m]ost [service] components [...] met their aggregate retention goals in the past 6 fiscal years [2000-2005], but the Navy experienced retention shortages in fiscal year 2005 [...]. The Navy did not meet its end-of-year retention goals: for service members with less than 6 years of service by about 2 percent and for service members with 6 to 10 years of service by about 8 percent" (GAO, 2005, pp. 8, 11).

2. Naval Officers

Targeted bonus pay has been used to meet Officer manning objectives. Current bonus pay programs have the common objectives of retaining trained and skilled officers while attracting new officers into specific career pipelines. The aviation, nuclear and surface warfare communities are among those Navy career fields in which bonuses are currently being implemented. Each bonus program differs in required commitment, bonus pay amount and applicability.

The aviation community offers Aviation Career Incentive Pay (ACIP), a monthly incentive for Officers who hold or are training for an aviation rating or designation, and Aviation Career Continuation Pay (ACCP), to encourage qualified

aviators who have completed their initial active duty service obligation (ADSO) to continue this Navy career path. The nuclear community offers the following targeted bonuses: the Nuclear Accessions Bonus, a signing bonus for officers pursuing a career involving Naval nuclear propulsion in the submarine or surface warfare community; the Nuclear Career Accessions Bonus, another one-time payment made after officers successfully complete the two phases of Naval nuclear propulsion training; the Nuclear Officer Continuation Pay (COPAY), a continuation bonus for nuclear-trained officers who accept a three-year to five-year contract extension; and the Annual Incentive Bonus (AIB), paid to nuclear-qualified officers wishing to continue service on an annual basis.

Of more specific interest to this research, the surface warfare community offers surface warfare officers (SWOs) several targeted pay bonuses: Surface Warfare Officer Continuation Pay (SWOCP or “SWO bonus”), paid to Officers obligating to complete one or more assignments as a Department Head afloat; the Junior Surface Warfare Officer Critical Skills Retention Bonus, an addition to the SWOCP, pays eligible lieutenants \$25,000 to stay in the Navy and in the SWO community through the ninth year of commissioned service and 2 Department Head tours; The Surface Warfare Officer Critical Skills Bonus, available to LCDRs, pays up to \$46,000 to remain on active duty in the Surface Warfare Community through the 15th year of commissioned service; and the Senior Surface Warfare Officer Critical Skills Retention Bonus (Senior SWO Bonus) offers CDRs serving in eligible billets a yearly bonus of \$15,000 and CAPTs in eligible billets \$20,000 per year. Nuclear-trained Surface Warfare Officers can receive the nuclear bonuses *in conjunction* with the surface warfare officer bonuses. Despite these targeted pay bonuses, The SWO community has experienced the lowest junior officer retention rate of all Unrestricted Line Officer (URL) communities since the early 1990’s.

Thus, the Navy is paying significant reenlistment and retention bonuses and still not consistently meeting its reenlistment and retention goals. The system is broken and needs to be fixed. This research will explore one possible ~~fix~~.”

B. Research Question

This research addressed the following questions:

1. Primary Question

Can a combinatorial auction mechanism providing individualized portfolios of non-monetary and monetary incentives more cost-effectively influence reenlistment/retention behavior than monetary incentives alone?

2. Secondary Questions

a. What auction design would allow the Navy to tailor monetary/non-monetary reenlistment incentive packages to individual Sailors while simultaneously economizing on Navy resources?

b. If both reenlistment incentive programs are optimally designed, what cost savings might the Navy expect by moving from purely monetary reenlistment incentives to a portfolio of monetary/non-monetary incentives?

c. How would population representation be affected by these reenlistment incentives?

C. Scope and Limitations

This report focuses on applying non-monetary incentives in a retention auction mechanism to two US Navy enlisted communities and one officer community. It does not address other services nor does it analyze other enlisted or officer communities. However, the general findings may be applicable to all services at any pay grade.

D. Methodology

The methodology in this research focused on three retention/reenlistment mechanisms: a purely monetary auction, a Universal Incentive Package (UIP) auction, and the Combinatorial Retention Auction Mechanism (CRAM). The latter two auctions included various non-monetary incentives (NMIs) that appeared to be

important to Sailors—according to prior research, as well as survey data garnered as part of this research.

The mechanisms were simulated; their outcomes compared, and their respective strengths and weaknesses explored. The main measure of effectiveness (MOE) was total cost to the Navy. This measure assumed constant reenlistment goals across mechanisms. The models, however, can easily be adapted to reflect a constant total cost assumption, with increasing/decreasing retention rate as the MOE.

A Naval Postgraduate School (NPS) student MBA project team conducted a survey asking Surface Warfare Officers (SWOs) what monetary bonus they would require to retain in the Navy for two Department Head tours (Denmond, Johnson, Lewis & Zegley, 2007). They were then asked how much of that money they would be willing to give up for certain non-monetary benefits. The non-monetary benefits included home port of choice, platform of choice, billet of choice, geographic stability, leave sabbatical (for education and pregnancy) and telecommuting. Appendix A contains a copy of the full SWO Retention Survey.

A follow-on NPS student thesis conducted a similar non-monetary incentive survey targeting enlisted Navy personnel—specifically the Air Traffic Controller (AC) and Fire Controlman (FC) ratings (Zimmerman, 2008). Appendix B contains a copy of the full Enlisted Retention Survey.

Information about the Sailors' valuation distributions for various non-monetary incentives, which was required to run the simulations, was not available. Thus, the survey was administered to obtain the necessary data. The survey method chosen provided quick turnaround time, ease of data collection, and uniformity of response format.

The data obtained from the SWO and Enlisted Retention Surveys was used in the simulations to estimate the performance of the three retention auctions. There is little to no information currently available regarding the cost to the Navy of the non-

monetary incentives (NMI) offered. The cost of the offerings was estimated based on the value distributions gleaned from the survey responses.

A mathematical simulation of the three auctions was created using Microsoft Excel and Oracle Crystal Ball. The model predicted individual retention outcomes, benefits received, total and per-Sailor cost to the Navy for the monetary-only, UIP, and CRAM auctions.

Two cost-estimation techniques were used, labeled Varying Percentile cost–All Positive (VP(AP)) and Varying Percentile cost–High Positive (VP(HP)). These costing models will be described in Chapter VI.

The final product is a program that is applicable to any community (enlisted or officer, surface or aviation) by simply changing the offerings and associated reservation values.

Survey questions provided the respondents an opportunity to answer in an open text format. Chapter IV summarizes and discusses these responses.

E. Organization of Study

This research is an on-going investigation into the cost-effectiveness of offering monetary/non-monetary reenlistment retention packages, or flexible benefits packages, to naval personnel.

Chapter II of this report reviews the auction design literature to identify the right mechanism for setting retention incentives and to consider how participants would respond to these mechanisms. Chapter III investigates how civilian corporations have pursued and implemented non-monetary benefit offerings. Chapter III also considers whether individuals can handle the complexities and volume of decisions required for the combinatorial auction mechanism proposed in this research.

Chapter IV addresses the SWO and Enlisted Retention Surveys, including administration, target population, sample statistics, and open-text responses.

Chapter V outlines the auction mechanisms' format and implementation. Chapter VI presents the auction simulations and results. Chapter VII discusses potential diversity implications of the CRAM for the enlisted population. Chapter VIII provides a summary, conclusions and recommendations.

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II. Auction Theory

Presently, the size or amounts of the Selected Reenlistment Bonuses are predetermined in “response to market forces as retention changes in ratings, NECs, and skills” (Chief of Naval Operations, 2007). Specifically, planners at the Naval Bureau of Personnel determine which ratings and Navy Enlisted Classifications (NECs) qualify as undermanned, as suffering from low retention or as having high replacement costs. They then determine the level of cash bonus at which the Navy can expect “a reasonable prospect of enough improvement in retention in response to the award to justify the cost” (2007). This determination is made primarily through use of the Annualized Cost of Leaving Model (ACOL). This model theorizes that individuals compare their projected Military earnings stream with their possible civilian earnings stream plus their taste for civilian life to determine whether to continue military service (Hansen & Wenger, 2005, p. 33).¹ By using this model, planners derive the estimated minimum SRB amount that would induce the requisite number of Sailors to stay in the Navy.

A. Cost of Retention Mechanism Currently Used by the Navy

By using a predetermined SRB amount as described above, Navy planners are actually attempting to determine the marginal SRB required by the final (or most reluctant) Sailor that must reenlist to meet end-strength targets. Unfortunately, all previous (or more-willing) Sailors must also receive this amount under the current system, as shown in Figure 1.

If planners underestimate the optimal SRB level (i.e., set the bonus too low), too few Sailors will be willing to retain; the Navy will not meet end-strength goals, and readiness will suffer. If planners overestimate the optimal SRB level (i.e., set the bonus too high), too many Sailors will want to retain and the Navy could overshoot its end-strength goals. This would result in budget overages.

¹ Hansen and Wenger suggest including “basic pay, allowances for subsistence and housing, and retirement pay [... and any] SRB for which the individual is eligible.”

Alternatively, if the bonus was set above the optimal SRB level, reenlistments could be suspended once end-strength was reached. This would be sub-optimal, as retention would be first-come first-served—heavily favoring those whose end of active obligated service (EAOS) falls in the first half of the fiscal year. This would be unfair to those with later EAOS dates, and it would not retain those Sailors (regardless of EAOS date) who are most willing to remain in the Navy, raising later retention costs.

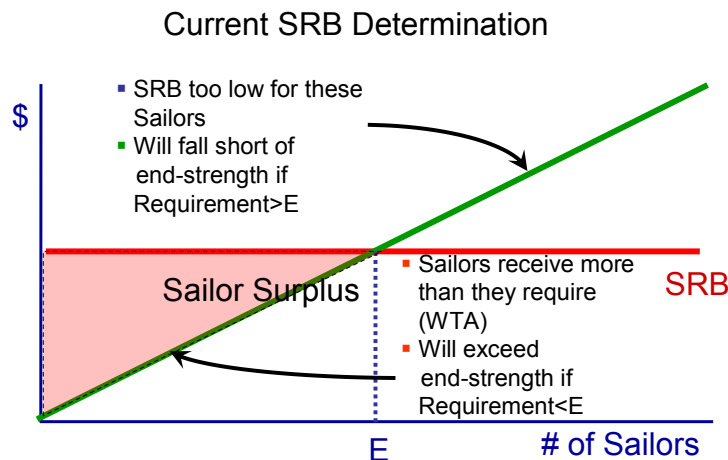


Figure 1. Cost of Existing SRB Determination

The green line in Figure 2 represents the labor supply curve or Sailors' reservation costs to remain in the Navy. The blue line represents the optimal SRB. The two red lines illustrate the result of setting the SRB level too high or too low.

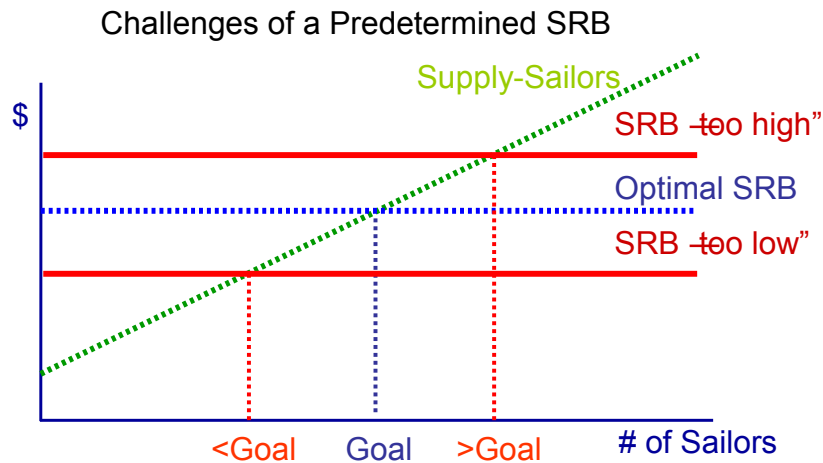


Figure 2. Predetermined SRB Challenges

This report will illustrate an auction mechanism that endogenously determines the precise (and minimum) SRB level necessary to induce the right number of reenlistments and overcome the flaws of the current system. Theoretically, a retention auction would not only set the market-clearing SRB level for the current labor supply and demand conditions, but would also identify the Sailors to be retained.

B. Auction Design

The Encarta Dictionary defines an auction as, “a sale of goods or property at which intending buyers bid against one another for individual items, each of which is sold to the bidder offering the highest price.” This actually defines the most widely understood auction: a *forward auction*. There are numerous variations on this common type of auction, some of which will be discussed in the following sections.

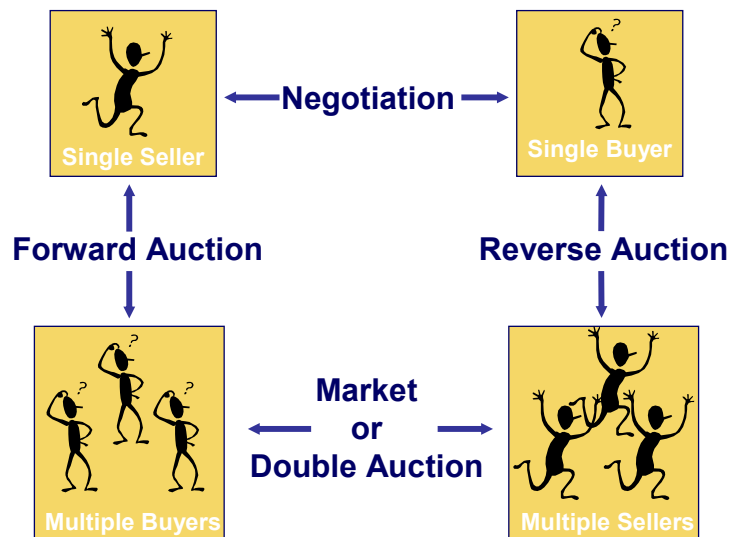


Figure 3. Auction Variations

An auction is, more precisely, —an exchange mechanism” that allocates resources to the winning bidder. Whether the winner is buying or selling, how many winners there are, and the price the winner pays or receives is determined by the auction variation.

1. Auction Variations

This section will discuss some of the most common auction variations, specifically those germane to this research. Additionally, an introduction to the combinatorial auction, which is less common, will be provided.



Figure 4. Common Auction Variations

a. Single-winner Forward and Reverse Auctions

In a forward, single-winner auction, there is one seller and multiple buyers. The winner is the highest bidder. This is the most widely known type of auction. A reverse, single-winner auction is characterized by multiple sellers and one buyer. An example of this is the competition for government contracts. The winner is the *lowest* bidder.

For simplicity, the following auction types will be described using a forward, single-winner auction—unless otherwise noted.

b. Open-bid vs. Sealed-bid Auctions

Open-bid auctions are those in which bidders openly declare their bid amounts or intentions. Open-bid auctions can be ascending (English auction). The bidding starts at a minimum price, and the auctioneer increases the bid incrementally until there are no more takers. They can also be descending (Dutch auctions). The auctioneer starts at a predetermined price (high enough so that no bidder is interested) and decreases incrementally until a bidder accepts that price.

Sealed-bid auctions are those in which bid amounts are submitted (often in a roughly simultaneous fashion) without any disclosure until after the winner is determined. Sealed-bid auctions come in two common variations. In a first-price

auction, the winner is the highest bidder, and the winner pays the amount bid. In a second-price (Vickrey) auction, the winner is still the highest bidder; the price the winner pays, however, is the bid of the next highest (or first excluded) bidder.

c. Reverse, Second-price, Sealed-bid Auction

Given the retention context, this thesis will focus on reverse auctions. In a reverse auction, there is only one buyer (for example, the Navy) and many sellers or bidders (the Sailors offering their services). While the results of this thesis generalize to other reverse auction formats, the focus will be on reverse, second-price, sealed-bid auctions. In a reverse, second-price auction, the lowest bidder provides the goods or services (military labor in this case), but *at the price of the first excluded (next highest) bidder*.

There will be further discussion of the specific auction formats analyzed in Chapter IV.

d. Bidding Strategy: Second-price Auction

Under a second-price auction, the optimal bidding strategy is to bid one's true valuation. For example, if an individual is bidding for an item valued at \$30 (representing a maximum willingness to pay of \$30 for the item), then the best strategy is to bid exactly \$30 for the item in a second-price auction.

To understand this result more clearly, this section will illustrate how one can never do better than bidding truthfully in a second-price auction. For simplicity, the explanation that follows employs the following notation:

V = Participant's value for the object

P = Price paid for the object

S = Participants surplus

B = Participants bid for the object

H = Highest bid submitted by any other bidder

The following section will first demonstrate that bidding *above* your true value (i.e., choosing $B > V$) can only hurt you. It will then demonstrate that bidding *below* your true value (i.e., choosing $B < V$) can only hurt you. Figure 5 illustrates the three possible cases or outcomes which can result from bidding above your true value. Figure 6 illustrates the three possible cases or outcomes which can result from bidding below your true value.

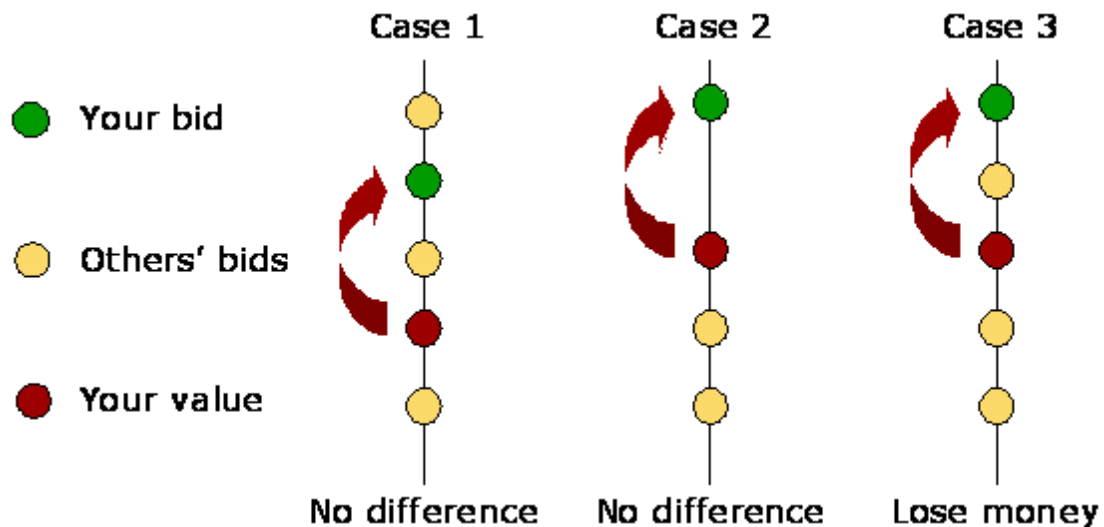


Figure 5. Bidding above Your Valuation

For all cases, the reader should note that the participant's objective as a bidder is to maximize your surplus, S . If you do not submit the highest bid (i.e., if $B < H$), then $S = 0$. If you do submit the highest bid (i.e., if $B > H$), then $P = H$, and your surplus is given by $S = V - P = V - H$.

Case A1: $H > B > V$

In this case, because $H > B$, you are not the high bidder and you do not win the object; therefore $S = 0$. If you bid truthfully ($B = V$), you also do not win the object (because $H > V$) and, therefore, would also have $S = 0$. Thus, bidding above your true value provides no benefit in this case.

Case A2: $B > V > H$

In this case, because $B > H$, you are the high bidder and win the object; therefore $S = V - H > 0$. If you bid truthfully ($B = V$), you also win the object (because $V > H$) and, therefore, would also have $S = V - H$. Thus, bidding above your true value provides no benefit in this case, either.

Case A3: $B > H > V$

In this case, because $B > H$, you are the high bidder and win the object; therefore $S = V - H$, which is *negative*, because $H > V$: you ~~win~~ the object, but pay more than it is worth to you. If you bid truthfully ($B = V$), on the other hand, you would not win the object (because $H > V$) and, therefore, would have $S = 0$. Thus, bidding above your true value hurts you in this case. You would be better off bidding truthfully.

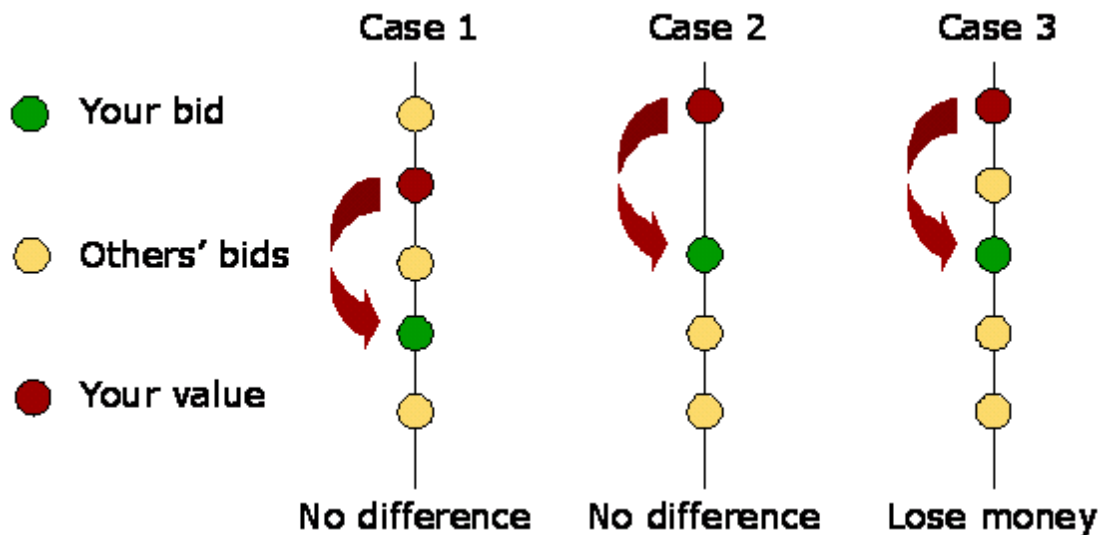


Figure 6. Bidding below Your Valuation

Case B1: $H > V > B$

In this case, because $H > B$, you are not the high bidder and do not win the object; therefore $S = 0$. If you bid truthfully ($B = V$), you also do not win the object (because $H > V$) and, therefore, would also have $S = 0$. Bidding below your true value provides no benefit in this case.

Case B2: $V > B > H$

In this case, because $B > H$, you are the high bidder and win the object; therefore $S = V - H > 0$. If you bid truthfully ($B = V$), you also win the object (because $V > H$) and, therefore, would also have $S = V - H$. Thus, bidding below your true value provides no benefit in this case.

Case B3: $V > H > B$

In this case, because $H > B$, you are not the high bidder and do not win the object; therefore $S = 0$. If you bid truthfully ($B = V$), you would win the object (because $V > H$) and, therefore, would have $S = V - H$. This is positive because $V > H$. Thus, bidding below your true value hurts you in this case. You would be better off bidding truthfully.

This demonstrates that bidding anything other than your true value in a second-price auction can only hurt you. Under this auction format, truthful revelation ($B = V$) is the optimal bidding strategy.

e. Bidding Strategy: First-Price Auction

Under a first-price auction, it is immediately apparent that truthful revelation ($B = V$) is NOT the optimal bidding strategy. If you are the high bidder (i.e., if $B > H$) under a first-price auction, you will win the object, but the price you pay will be the amount you bid (i.e., $P = B$). Therefore, you will earn no surplus ($S = V - P = V - B = V - V = 0$). Instead, the optimal strategy is to bid some amount below your true value (i.e., to bid $B < V$).

By how much should you “underbid” your true value in a first-price auction? To answer this question, consider that if all bidders underbid their true values by the same fraction or amount (or, more generally, according to the same underbidding or discounting rule), the winning bidder will always be the bidder with the highest value for the object.

Because $S = V - P = V - B$ only if you win the object, and $S = 0$ otherwise, the amount you bid only matters if you win the object. This means that you might as

well bid as if you are the winning bidder, i.e., the bidder with the highest value for the object.

Identifying the optimal bidding strategy in a first-price auction boils down to answering the following question: if you have the highest value for the object among all bidders, how low can you bid and still win the object? The answer is that you can bid as low as the second highest bid, which you can safely assume will be at or below the second highest value for the object. Thus, the optimal bidding strategy (technically, the “~~equilibrium~~” bidding strategy) in a first-price auction is to bid what you expect the next highest value would be if your value for the object was the highest value among all bidders.

f. Revenue Equivalence

One interesting and important implication of the above-described optimal bidding strategies is that, on average, the seller of the object can expect to receive the same revenue—whether the object is sold via first-price or second-price auction.

To see this, note that the price (or revenue) in a second-price auction will be equal to the second-highest bid. Because the optimal bidding strategy is to bid truthfully, this will be equal to the second-highest value. Under a first-price auction, the price (or revenue) will be equal to the absolute highest bid. In equilibrium, the high bidder in a first-price auction will bid what he expects to be the second-highest value.

Thus, under either auction format, the expected price is equal to the expected second-highest valuation. Thus, in general, the expected revenue for the seller under either auction format is the same.

C. Prior Thesis Work

Hudson (2006) addressed the choice between a first- and second-price auction design with respect to the Navy’s Targeted Separation Incentive Program. He found that the second-price, sealed-bid auction —is the most efficient manner to

conduct separation auctions because of its efficiency, cost effectiveness, equitability and practicality, based on recent market design and auction theory” (p. 38).

Bock (2007) applied a two-stage auction mechanism, called the Sequential Self Selection Auction Mechanism (S3AM), to Marine Corps Reenlistments. He estimated the potential cost savings by properly determining Selected Reenlistment Bonus levels. He showed further cost savings from using a two-stage auction in which bidders have an incentive to reveal when they are more willing to retain. In this self-selecting, two-stage auction mechanism, Sailors more willing to retain will select a lower, but longer-term bonus as opposed to a higher, but riskier bonus.

Norton (2007) designed an experiment to determine whether this sequential auction would be truth-revealing and successfully separate more-willing-to-retain Sailors from less-willing-to-retain Sailors. The experiment also indicated whether participants would be able to accurately determine their optimal bidding strategy without prior training and education on the subject. Cook (2008) analyzed these experiments and found that most participants quickly determined the most beneficial strategy (truthful revelation) and adopted it consistently. With the two-stage mechanism, the employer (Navy) recaptured approximately 25% - 30% of the employees' (Sailors') surplus compared to a single-stage auction.

Tan (2006) applied a two-sided matching mechanism with money to the Sailor assignment problem. This mechanism determines Assignment Incentive Pay bonuses to attract Sailors to hard-to-fill jobs. The assignment bonus reflects preferences on both sides of the market: the Sailors' preferences over jobs and the jobs' preferences over Sailors. Using Monte Carlo simulation to model the process, Tan (2006) found that the proposed mechanism was most efficient.

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III. Determining Offerings

The major advantage to a solely pecuniary compensation system is its simplicity: cash pay is easy to identify and quantify. Few compensation plans, however, are this simple. It is to the employee's advantage to have a portion of his wages consist of non-monetary benefits. Savings achieved through economies of scale and corporate tax deductions in health care plans is an example. Paid vacation and sick days are another example of non-cash benefits that work to the advantage of the employee. Hattiangadi (2001) notes that —only 80 percent of surveyed workers say that benefits are very important in their decision to accept or reject a job” (p. 8). According to the Bureau of Labor and Statistics, the percentage of employees in medium and large companies with access to flexible benefits increased from 5% in 1988 to 13% in 1999 (GAO, 2002a, p. 57). In 2006, that number had risen to 28% of companies that employ 100 or more people (TED, 2007).

The Chief of Naval Operations has defined recognition of the Navy as a top 50 employer in the United States as one of his goals for 2008 (Roughead, 2008). By examining the effort of leaders in Corporate America, the Navy can adapt and adopt their best practices to achieve this goal.

A. Corporate Non-monetary Incentive Efforts

1. Total Rewards

The Corporate Leadership Council (CLC) suggests implementing a Total Rewards philosophy with respect to compensation. —A total Rewards philosophy is a strategic means of merging the roles of the compensation and benefits function. This approach focuses on the monetary and non-monetary incentives used to attract, engage, and motivate human capital” (2008b, p. 1).



Figure 7. Components of a Total Rewards Philosophy

(Corporate Leadership Council, 2008b, p. 2)

They define a total rewards package as being comprised of all of the reasons why —a talented individual would want to work and remain at a company” (2008b, p. 2). This philosophy must be clearly defined and shared with organizational employees. Employees must know that the purpose of Total Rewards is to focus on serving the workforce, as well as organizations’ business objectives” (2008b, p. 3). Additionally, employees must be educated as to the true value of their *total* compensation.

This final point is especially relevant to the Navy. Hattiangadi notes that —[c]urrently, information about the various benefits offered to military personnel and their families is scattered among an array of websites and publications. Most private-sector companies offer materials of this type, so such a move would facilitate comparison of offered private-sector and military compensation packages” (Hattiangadi, 2001, p. 127).

2. Navy-civilian Comparison Message

The Navy attempts to achieve employee recognition of benefits by releasing an annual message that compares military earnings with their civilian equivalents. While this is a worthwhile endeavor, it may not have the desired impact. Most Sailors are unaware of the true value of the Navy’s compensation package. By implementing a benefits system in which Sailors choose to keep and reject various

non-monetary benefits, they will be forced to examine and understand the value of their compensation packages.

A recent Naval Message (Chief of Naval Operations, 2008) illustrates the significance of benefits in the overall military compensation package when compared to similar civilian occupations:

A Petty Officer Second Class Aviation Mechanic [AM2] stationed in Norfolk with two dependents and over four years of service[‘s] [...] military gross annual salary is approximately 46,487 dollars as compared to a private sector counterpart at approximately 43,790 dollars. Breaking down the Petty Officer’s total annual salary, this Sailor is making about 3,533 dollars in BAS [Basic Allowance for Subsistence], 15,324 dollars in BAH (w/dependents)[Basic Allowance for Housing with dependents], 680 dollars clothing maintenance, and base pay of 26,968 dollars. Unlike her private sector counterpart, the Petty Officer receives a tax break because allowances such as BAH and BAS are not subject to Federal Income Tax. This tax advantage increases the value of the Petty Officer’s annual salary by 5,721 dollars. As a civilian, the Aviation Mechanic in this example would have to earn about 52,000 dollars to have a comparable after-tax income. This amount does not include annual indirect compensation attained such as medical, dental, vision and commissary benefits which add up to approximately 6,785 dollars. (Chief of Naval Operations, 2008)

This message also points out the defined-benefits retirement plan that is provided at no direct cost to the member:

If this same Sailor makes an informed decision and decides to stay Navy and retire after 24 years as a Senior Chief Petty Officer, she can expect [...] [under the] High-3 Military Retirement, payout over 40 years of over five million dollars. As a civilian [she] would have to accrue 2,652,892 dollars at the time of retirement to receive a comparable payout. In order to achieve this amount, [she] would have to invest 57,972 dollars annually at an eight percent return over a 20-year period. (Chief of Naval Operations, 2008)

3. Example: The Royal Bank of Scotland

The Corporate Leadership Council (CLC) analyzed the Royal Bank of Scotland’s (RBS) efforts when introducing a flexible benefits plan to its employees. RBS offered flexibility in existing medical and dental coverage, various levels of

group rate additional insurance policies, childcare vouchers, discounted retail vouchers, and the opportunity to buy or sell vacation days among many other benefits. They determined the mix of offerings based on employee focus groups, questionnaires, and manager interviews. They defined the advantages of a flexible benefits program at RBS, as shown in Figure 8.

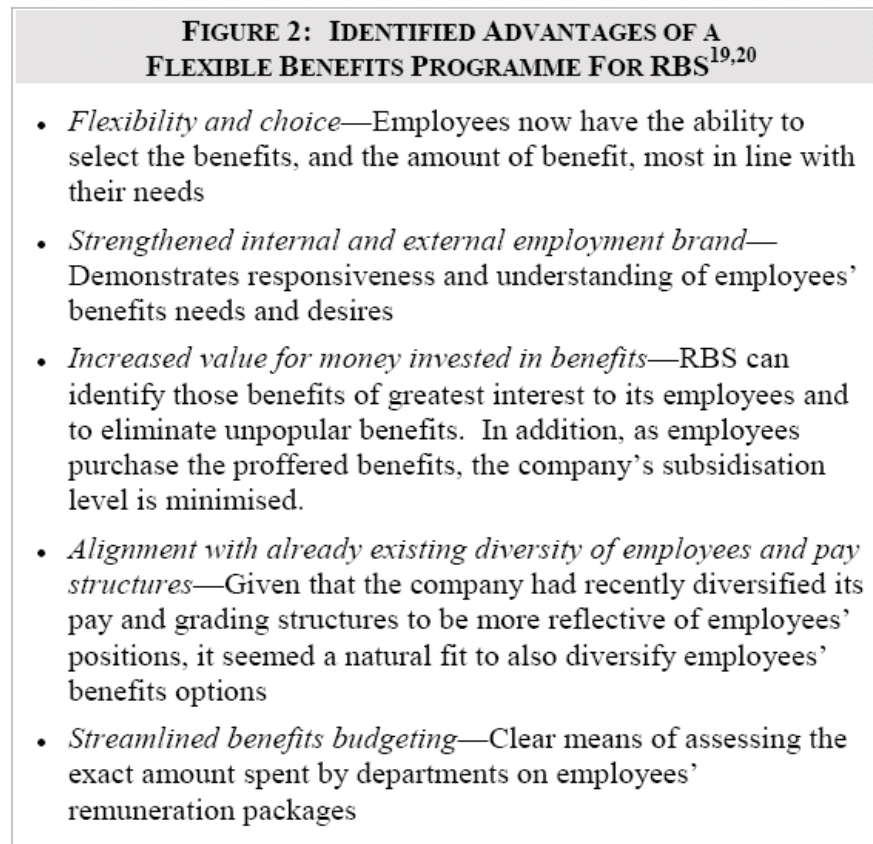


Figure 8. Advantages to RBS Flexible Benefits Plan
(Corporate Leadership Council, 2008a)

CLC found that RBS met all of its objectives by introducing the plan. RBS achieved significant employee participation, employee satisfaction, recognition as an employer of choice in the United Kingdom, and company satisfaction in terms of cost-effectiveness and the ability to offer benefits most desired by employees (2008a).

4. Employee Satisfaction, Communication and Distributive Justice

Another important question is how flexible benefit plans affect employee satisfaction. More satisfied employees are more likely to stay at a company and require less monetary incentives (Ehrenberg & Smith, 2008). This reduces retention and turnover costs. Tremblay et al. (1998) attempted to determine what influences employee satisfaction and, more specifically, how flexible benefit plans influence employee satisfaction. They linked these research objectives to the organizational goals —“to maintain satisfaction levels and at the same time control costs” (1998). They further refined their research objectives by presenting and testing nine hypotheses:

1. The more importance individuals attach to benefits, the more satisfied they will be with those benefits.
2. There is a positive relationship between inter-organizational mobility and benefit satisfaction.
3. There is a positive relationship between perception of security and satisfaction with benefits.
4. There is a positive relationship between the perception of distributive justice and benefit satisfaction.
5. The perceived importance of benefits plays a moderator role in the relationship between distributive justice and benefit satisfaction.
6. There is a positive relationship between the perception of involvement in decisions related to benefits and benefit satisfaction.
7. There is a positive relationship between the perception that employee preferences are considered and benefit satisfaction.
8. There is a positive relationship between communication received and benefit satisfaction.
9. There is a positive relationship between flexibility of benefits and benefits satisfaction. (Tremblay et al., 1998, pp. 671-676)

To test these hypotheses, the authors examined the effects of three distinctly different benefit plans: a traditional Fixed-benefits plan employed by an insurance company, a Modular Flexible plan (different benefit bundles to choose from) used by

a University, and a Core-plus plan (a core group of essential benefits plus other options that employees can add to the core) used by a drinks manufacturing company. They surveyed employees in each firm to capture the employees' perceptions of fairness, communication, security, and flexibility of benefits with respect to job satisfaction. By comparing these three types of plans, they were able to examine the effects of each level of flexibility—from none to maximum—to test their hypotheses.

They cite various studies that suggest that by introducing employee flexibility and choice, employers will simultaneously increase employee satisfaction and control the rising costs of providing benefits—especially health care.

The authors incorporate demographic controls in their model and, additionally, include variables designed to capture the concepts described in the hypotheses—such as benefit importance, perception of distributive justice, level of participation in the decision, and communication level of the organization. They obtained these measures through the survey given to employees in the three firms.

Their choice of three distinctly different *firms* was questionable. They note that —~~some~~ differences in respondent profiles emerged from the data” (Tremblay, 1998, p. 676). They report a high response rate, 42.2%, but fail to mention how representative that response was except to state that it was not entirely in keeping with the individual firm profiles. This leads the reader to question how applicable these findings are to the rest of the business community.

They were highly successful in establishing an argument for further research into flexible benefits packages and their impact on employee satisfaction, cost reduction, and attraction of non-traditional employees. Of the nine hypotheses, five were confirmed; one was refuted and three had inconclusive findings. They found communication to be the most influential aspect of benefits satisfaction. This was followed by perception of distributive justice.

This research reveals the tremendous potential of flexible benefits packages. It also underscores the necessity to communicate the scope of the company's benefits offerings and to establish faith in the fairness of benefits allocation. To make an informed decision between employment opportunities, employees must be aware of the entirety of their compensation package.

Tremblay et al. (1998) also found some evidence to suggest that individuals value the ability to choose as highly as the actual choices themselves (Van Boening, Blackstone, McKee, Rutstrom, 2006). But can people handle such a large volume of complex choices?

B. Private-sector Experience

Ballentine (2003) states that, as with monetary incentives, non-monetary incentives need to be tailored to the individual worker. Ballentine has found that younger workers are looking for an increase in workplace satisfaction in terms of environment, while older workers are looking more toward their retirement and incentives to aid their transition, such as part-time and temporary work opportunities. The non-monetary incentives mentioned include sabbaticals, part-time and temporary work, feedback from superiors, flexible work schedules, attentive employers and professional development.

Ballentine found that incentive packages differed by age, needs and career stage; younger employees were offered packages emphasizing retention while older employees were offered packages emphasizing retirement incentives. However, Ballentine stresses that incentives can disrupt the workforce by making employees competitive rather than team players and that incentives can decrease job satisfaction, interest and motivation.

Cohen (2006) states that non-monetary incentives can be effective in the healthcare profession and can retain employees by increasing their overall satisfaction. The article is based on everyday, small incentives such as professional development, —thank-yous” from supervisors, and whole staff recognition by employers. Overall, employees were happy that the culture of the business

changed, and they felt they were able to appreciate their job more (based on a survey used to measure incentive success). The managers also found that simple incentives were better and easier for all employees and employers.

Dolan (1996) points out various non-monetary incentives that help major private companies—such as Sprint, Disney, and Northern Telecom—retain their employees. Non-monetary incentives were introduced because human intelligence has become so much more valuable in the job market. Companies did not have a choice but to give employees more options to attract and retain the best workers. Some of the incentives mentioned are on-site laundry service, flex-time/working from home, an on-site handyman who is available to do home repairs, on-site public schools, and service opportunities. One worker pointed out that her flex-time actually allowed her to work more hours and be more productive because she can take care of her family and work during her off time. Overall, this article points out that the employer needs to know its individual employees to provide appropriate incentives.

Falcone (2002) focused on the private finance sector. He states that managers need to provide employees ways of increasing their internal motivation to motivate and retain them. To do this, he believes that employers should provide professional development opportunities outside of the company and give employees tools to self-evaluate, be it in writing or in group sessions.

Simms (2007) from the UK's *People Management*, defines non-monetary as non-cash, meaning that the incentive is not employee payment but can cost the company money. Simms notes a survey that found 38.6 percent of employees improved their performance when given non-monetary (non-cash) incentives, while only 14.6 percent improved with monetary incentives. Simms gives various examples of non-monetary incentives such as employee parties, employee award ceremonies, parking spaces for hard workers, flexible work schedules and longer maternity leave. As in previous articles, Simms found that non-monetary incentives rely heavily on knowing the employee's individual needs.

In another article, Warren (2006b) explains that non-monetary incentives are considered to be —~~ex~~perience incentives.” These are similar to non-cash incentives in that though the employee does not receive any money, the incentive does cost the company money. Employees are able to earn experiences such as a trip to China, part ownership of a private jet, and backstage passes to rock concerts. Companies in the UK have found that —~~ex~~perience incentives” have increased employee motivation and performance. Before beginning any incentive program, the author points out that the business should have a clearly defined business goal—such as staff attraction and retention, improving internal communication, reinforcing brand behavior, igniting sales, increasing productivity, curbing spending, boosting customer satisfaction or driving overall efficiency.

The top non-monetary incentives mentioned by Warren (2006a) are flexible hours, working from home and longer vacation leave. Warren also points out that the most popular non-monetary incentives are parking spaces, free medical evaluations, gym memberships, paid spa days, on-site massages and laundry facilities, take-out kitchens and corporate cottages. The article states that often retaining employees can be as simple as offering positive feedback, recognition and a pat on the back.

Berry (2005) finds that non-financial incentives will increase employee retention and performance; the example of non-financial incentives is a family-friendly work environment.

Hemsley (2004) plays down the impact of financial incentives, stating that the benefits of these incentives die down quickly. Hemsley argues that to create long-term employee motivation and retention, employers must offer non-monetary incentives such as positive feedback, public recognition and opportunities for hard-working employees to benefit (e.g., allowed extra time off). For example, employees might earn points by working over-time or being recognized by their peers; these points could in turn be accumulated to —~~pu~~rchase” time off or flex time. This article

was accompanied by a website that shows different employee benefits:
<http://www.employeebenefits-confex.co.uk/eb/Default.aspx>.

Appelbaum and Kamal (2000) focus on how small businesses can compete with larger businesses to retain employees; they also provide some interesting ideas on what a non-monetary incentive involves. According to the authors, non-monetary incentives include flex time, job sharing, a team focus, greater employee autonomy, employee recognition, working from home, job clarity and equity in pay and expectations.

Hall (2006) focuses on the building industry and discusses various non-monetary incentives that have a lot in common with the non-cash incentives and “experience incentives” discussed earlier. Hall points out one company using “pay to go” awards for hard workers. Each time employees receive this award, they are entered into a raffle to win a free dinner. Employees who stay with the company also reach benchmark incentives after 10, 15, and 20 years, such as cruises or Hawaiian vacations. The entire company has a four-and-a-half day work week, closing at 1 p.m. on Fridays. The author points out that this perk not only increases work performance and employee retention, but also increases employee recruitment.

The Corporate Leadership Council (2004) indicates that companies use non-cash incentives, such as jewelry, watches and pins, to reward employees for their time spent at the company. Of six companies presented in this study from the high technology, pharmaceutical, banking, and automotive industries, the company with the most employees (50,000) spent \$525,000 on non-cash incentives. Employees received non-cash incentives with a value of \$25- \$170 depending on length of service. Incentives included: money clips, desk clocks, desk sets, lead crystal bowls, lead crystal decanter sets, Longine brass clocks, silver tea sets and Atmos clocks. All employees were equally eligible to earn all non-monetary rewards, as the company wanted the program to be as equitable as possible.

The Corporate Leadership Council (2005) indicates helping employees find a work-life balance is important to employee retention. Work-life balance initiatives include flexible work schedules, such as a compressed work week (four days with a three-day weekend twice a month) and working from home. Some employers also offered various career development incentives, such as conference opportunities, job rotations and mentoring programs. This study also suggested a phased retirement program. This program appeals to middle-aged workers looking toward retirement and older workers nearing retirement. A phased retirement program offers a health program linked to post retirement, pension and compensation programs, job flexibility and management support. Retirees who participate in this program were more likely to return to the company in some way—as contractors, part-time and temporary employees, or as mentors. According to this research, a phased retirement program actually saves a company money because it can rehire retirees and save money on training and errors.

The Corporate Leadership Council (2002) examined telecommuting and found that it benefits a company by enhancing recruiting, increasing productivity, raising retention rates, lowering real-estate costs, and reducing absenteeism. The council also found several non-quantifiable benefits, including energy conservation, increased family involvement, health improvements, increased employee freedom and preservation of the environment. However, the council found several quantifiable employer costs for telecommuting, including: computer equipment, home office setup, telecommunications, and training. Non-quantifiable costs include: resentment among non-teleworkers, failure to foster company loyalty, inconveniences to managers and hindering of teamwork.

Before introducing telecommuting, employers should set up a telecommuting policy which details costs, benefits, guidelines and disciplinary actions. Employers should also have a team of telecommuting supervisors and trainers. Johnson and Johnson provides an example of a telecommuting policy. Employees sit through a 90-minute orientation video on telecommunication. Employees also discuss how to measure their success, how to set up a home office and how to use technology to

communicate with others. Johnson and Johnson uses an intensive process to teach its employees how to telecommute and how to balance family life with work life when they are working from home to maximize employee success.

C. Confronting the Complexity of Incentive Choices

Van Boening et al. (2006, p. 511) conducted “individual-choice decision-cost” experiments to investigate the idea that flexible benefit plans have the potential to increase job satisfaction and retention. They posit that employees must perceive the new plan as more valuable *and* be willing and able to select the optimal combination of offerings. To test their hypothesis, the authors conducted “an experiment on choices over stylized benefits packages where discrete goods have multiple attributes affecting the payoff function” (2006, p. 511). The hypothesis tested was that individuals would be able to make “payoff-maximizing decisions in the presence of multiple attributes [...]. In effect, solve a complex programming problem” (2006, p. 512). The authors further theorized that subjects would develop heuristics to cope with these complex situations. This hypothesis was based on previous research aimed at determining whether “human decision making is intrinsically prone to errors [or] that it is fundamentally efficient” (2006, p. 512).

The experiments were conducted at the Mississippi research Laboratory at the University of Mississippi and the Business, Economics, Accounting, and Marketing Laboratory at the University of South Carolina. The subjects included 80 student volunteers from the respective Universities’ undergraduate business schools. No mention is made as to the demographic characteristics or selection method of the volunteers. However, the statistical model used for hypothesis testing included 79 individual dummy variables to cancel out potential individual biases.

The experiment consisted of a game designed to mimic the choices required to maximize payoff and satisfaction from a flexible benefits package. The objective was to choose the optimal combination of cells to achieve a payoff higher than the fixed payoff option.

The payoff from the game was the reward from selecting a certain number of cells. The subjects were aware at all times of the fixed payoff amount from declining to play the game (no effort), the maximum payoff from playing the game and individual values relating to the choices and their weights on the final payoff. The subjects also knew the time remaining and the payoff they had achieved as a result of their choices. They could select and deselect as many cells as they wished in the four-minute time limit. They were given a maximum cell value sum with which to achieve the optimal payoff from playing the game and were aware of the current cell value sum at all times. They could also choose the fixed payoff option at any time during the four-minute round. This design approximates the choices and constraints an individual might face when choosing his options under a flexible benefits plan.

The experiment consisted of a “2x design with [individual] cell payoff and fixed payoff option as the treatment variables” (2006, p. 512). The treatment variables were chosen to ensure the “variety of choices within a given matrix and the variety of optimal solutions across matrices [was] sufficiently rich for data analysis” (2006, p. 515). Other variables were kept constant to keep the “computational difficulty facing the subject [...] significant, but not overwhelming” (2006, p. 515).

In each round, the subjects were given the option of “playing a ‘cell selection’ game or accepting a known fixed payoff in lieu of playing the game.” Only 4% overall chose to take the fixed payoff. The low percentage of people selecting the fixed payoff “suggests that typical subject’s decision cost [of playing the game] is substantially less than 20[%] of the maximum payoff” (2006, p. 518). It also suggests that “the typical subject places a high implicit valuation on the flexibility in making choices as she is apparently confident in her ability to exceed the fixed payoff” (Van Boening et al., 2006, p. 523).

In 84% of rounds, subjects earned at least 90% of maximum payoff. When the cell payoff was low—20 versus 100 points per cell—the majority of subjects earned in the 97-100% range. “A relatively low cell payoff implies that cell value is more important in determining reward” (2006, p. 520). Therefore, for those that

place relatively low value on the number of benefits they receive, the individual value of those benefits is extremely important.

There was weak evidence that the higher the fixed payoff alternative, the more the subject earns. This has an interesting implication. The rules of the experiment were analogous to allowing employees to have the option of keeping their fixed benefits plan while shopping for the flexible plan. The authors suggest that the higher the perceived value of the traditional plan, the more likely it is that the optimal flexible plan will be discovered by the employee.

The authors identify three simple heuristics that the subjects developed:

–H:” Subjects focus on high cell values (700-1000); low number (<3) of cells selected; and decision cost: LOW / Payoff: LOW.

–M:” Subjects focus on medium cell values (350-750); 4-5 selected per round; and decision Cost/Payoff: between H and L.

–L:” Subjects focus on low cell values (100-350); >6 cells selected per round; and decision Cost: HIGH /Payoff: HIGH. (2006, p. 521)

At least 60% of subjects appeared to have used the L heuristic (high payoff with high decision cost) in each session; 50% fit into the category overall (meaning they used it every time); and less than 10% used the H heuristic (low decision cost/low payoff) in each session (only 5% used it every time) (2006, p. 522). This suggests that the majority of the people find the potential gain outweighs the mental effort required to complete the task.

In their book *Modern Labor Economics*, Ehrenberg and Smith note that —employers will tailor their compensation packages to suit the preferences of the workers they are trying to attract” (2008, p. 269). Van Boening, et al.’s model (2006) allows the employer to offer a menu of choices and the employees to choose which options suit them. This theory goes on to suggest that the mere presence of a choice is itself a benefit and that a flexible benefits package may be strongly preferred to a pre-defined benefits package” (2006, p. 523).

The model does not suggest what these benefits should be. Rather, it is up to the employer to tailor offerings to suit target employees. The literature suggests the benefits' respective values will differ between individuals. This seems to be a reasonable assumption, and the model allows for this by varying the treatment variables and providing choices between the cell values in a substantial range.

Because most subjects chose to play the game and exceeded the fixed payoff value, the results demonstrate that a flexible benefits package will increase employee job satisfaction. This will aid employers in retention and possibly attract a larger applicant pool from which to draw. The Navy could benefit from such a plan. This is based on the following conclusions from this study:

1. People value having choice almost as much as they value the choices themselves.
2. People achieve a higher payoff when the fixed payoff is relatively high, but less valuable than the flexible plan's payoff. This suggests that employers should offer a fixed plan with comparable, but less valuable offerings, in addition to the flexible plan. (2006, p. 523)

Most people are willing to exert the mental effort to exceed the no-effort reward—even if the easy (fixed) payoff is 80% of the possible complex-effort payoff.

People can easily handle this complex decision-making task. The subjects, however, were college students. To determine applicability to the Navy enlisted community and to determine if there are significant differences, a similar experiment should be run on high-school graduates, non-high-school graduates, and alternative degree holders.

D. Identifying the Best Non-monetary Incentive Offerings

The study by Denmond et al. (2007) represents the starting point for determining which incentives to include in the SWO and Enlisted Retention Survey and the subsequent simulated retention auctions. Their results showed the top non-monetary compensation attracters for Surface Warfare Officers to be: increased graduate education opportunities, guaranteed base housing, geographic stability,

leave sabbatical, telecommuting, and additional money for dependents (education and daycare). These incentives were adjusted in the enlisted Sailor survey to reflect enlisted Sailor attributes—such as tour length and educational achievement—and was modified and expanded to suit the Enlisted Community’s distinct needs. Several previous Navy retention and benefits studies were analyzed; additional incentives, such as shipboard berthing options, lump-sum SRB payments, transferability of GI Bill benefits, and professional certification programs were also added to the enlisted survey.

1. Results of Previous Conjoint Analysis

The Center for Naval Analysis (CNA) conducted a Choice-based Conjoint survey to determine “which [Quality of Service (QOS)] factors are most important to the fleet’s Sailors and how do these QOS factors compare with pay in terms of their power to keep people satisfied and in the Navy?” (Kraus, Lien & Orme, 2003, p. 11). They specifically wanted to determine:

1. What are Sailors’ preferences?
2. What is the strength of those preferences?
3. What tradeoffs do Sailors make between pay and non-pay factors when making reenlistment decisions?

—In an analysis of the [survey] data, the relevant constraint is the Navy budget. Specifically, the Navy is looking for information that will help to identify the most valued and potentially most cost-effective QOS programs among a variety of possibilities” (2003, p. 13). This study did not measure the absolute value of present and potential compensation components. Rather, it measured the relative value of these components as compared to the increases in pay required to achieve comparable results. Kraus et al. explain:

The survey results indicate that, even with several measures of pay included in the survey, non-pay factors play a substantial, measurable role in guiding Sailors’ reenlistment intentions. More specifically, the two highest impact QOS improvements are location and duty-type assignment guarantees. These non-pay factors had pay-equivalent values of 5.7 and 4.3[%],

respectively, indicating that Sailors value these guarantees as much as pay increases in the range of 4 to 6[%]. (2003, p. 3)

Other non-monetary incentives that had a significant positive value when compared to monetary offerings were guaranteed time for voluntary education and increased shipboard living space. Requiring Sailors to live onboard a ship while in port had the largest overall effect—significantly negative. If this requirement were reinstituted, the study found that a 12.5% increase in basic pay would be required to maintain current reenlistment rates (2003, p. 62). The CNA study did not include many of the benefits included in this thesis's survey, such as leave sabbatical, telecommuting, compressed workweek, and transferability of GI Bill benefits.

2. The “Mix”

The CNA Research Memorandum *Military Compensation Reform in the Department of the Navy* (Hansen & Koopman, 2005) summarizes the Department of the Navy's Human Capital Strategy and Guiding Principles as issued by the Assistant Secretary of the Navy, Manpower, and Reserve Affairs (ASN (M&RA)).

The seven strategic objectives for creating a well performing, efficient, balanced, and effective human capital system [...] are to (1) inspire, (2) develop, (3) compensate, (4) recruit and access, (5) manage, (6) shape the force, and (7) separate or retire [...] through [seven] goals” (2005, pp. 8-10):

1. *Recruit* the proper number of high quality people with the skills required for the terms of service needed.
2. *Retain* the proper number of high-performing personnel with the right skills and experience for the terms of service needed.
3. *Inspire Attainment of the Highest Standards of Performance (Attain High Performance)*, including motivating high levels of individual and collective performance, productivity, and contributions needed for the naval Services to successfully accomplish their missions.
4. *Reward Exceptional Performance* through appropriate means, both monetary and nonmonetary.
5. *Assign* the best people, with the required skills and experience, to perform the needed work, where and when needed.

6. *Motivate Professional Development (Motivate Development)* that fosters a culture of professional interest and growth so that people willingly acquire and use the skills, knowledge, and abilities required for specific jobs.
7. *Facilitate Career Transitions (Facilitate Transitions)* at appropriate times between active, reserve, civilian, retired, and volunteer status in response to workforce requirements. The compensation system should allow and encourage people to pursue rewarding work/life opportunities throughout their careers. (2005, pp. 8-10)

The Guiding Principles that help decision-makers support these objectives are to ensure that programs and policies are:

1. *All Volunteer*: The Department's compensation policies support an all-volunteer workforce; members perceive their compensation as "fair and equitable."
2. *Flexible, Responsive (Flexible)*: The Department must be able to quickly and effectively change compensation policies to respond to changing market conditions and Service requirements [...].
3. *Strategic Best Value (Best Value)*: The Department's compensation policies must be aligned with other elements of their larger human capital strategy to produce the highest value, maximizing contribution, and minimizing cost [...].
4. *Support Achievement of Strategic Objectives and Outcomes (Support Objectives)*: Rational Compensation Policies support a hierarchy of strategic objectives and outcomes for successfully competing for talent and rewarding performance and recognizing contribution to mission. (2005, p. 10)

The study evaluates the Navy's current major compensation tools and how well they follow the four principles and satisfy the seven objectives. Hansen and Koopman (2005) demonstrate that there is not a single compensation tool available to the Navy at this time that satisfies all objectives. Most of the compensation tools do not fulfill half of the goals and adhere weakly—if at all—to the guiding principles. Figure 9 shows the scorecard for Retirement Pay, which is the worst-performing compensation tool. Figure 10 shows the scorecard for Basic Pay, which is, not surprisingly, the best-performing tool.

Goals		Principles	
Retirement Pay			
Recruit	No: overall a large portion of pay, but too heavily discounted for new recruits.	All Volunteer	Yes.
Retain	Incorrectly: drives across-the-board retention and transition patterns for YOS1-30 years	Flexible	No: doesn't support variable career lengths, innovative career paths, exit and entry.
Attain High Performance		Best Value	No: can't target force management element by service skill, time, etc.
Reward Exceptional Performance		Support Objectives	
Assign			
Motivate Development			
Facilitate Transitions	Incorrectly: drives across-the-board retention and transition patterns for YOS1-30 years		

Figure 9. Retirement Incentive Scorecard (*After Military Compensation Reform*)
(Hansen & Koopman, 2005, Appendix C)

After analyzing the current tools available to the Navy, they suggest a flexible (or cafeteria) plan: “if the employer can provide in-kind benefits in a way that allows people to retain some decision-making authority over their consumption choices, the value of the in-kind benefits will be higher. This is the motivation behind cafeteria or *Flexible* benefit plans, which are becoming more prevalent with private-sector employers” (2005, p. 79).

Goals	Principles		
	Basic Pay		
Recruit	Yes.	All Volunteer	Yes.
Retain	Yes: especially at first reenlistment.	Flexible	No: Congress can adjust levels but cannot vary by service or occupation.
Attain High Performance	Somewhat: depends on the increase in basic pay associated with promotion and length of service.	Best Value	Weakly: Not targeted, but better than benefits.
Reward Exceptional Performance		Support Objectives	Yes.
Assign			
Motivate Development			
Facilitate Transitions	Weakly: by flattening out at higher YOS.		

Figure 10. Basic Pay Scorecard (After Military Compensation Reform)
(Hansen & Koopman, 2005, Appendix C)

They further suggest that:

[o]nce an optimal mix of cash and in-kind benefits is determined [...], as much choice as possible should be offered among different benefits (e.g., cafeteria plans). In this way, the DON's benefit package will best align its guiding principles of being *Flexible* and *Best Value* while *Supporting the Objectives* often met through noncash compensation. (2005, p. 72)

Their final recommendation includes a quality-based compensation plan, which will not be addressed in this research. The focus of the Combinatorial Retention Auction Mechanism (CRAM) is to achieve cost-effectiveness while maintaining current quality. The current system of evaluations and retention recommendations is sufficient to maintain acceptable levels of quality. Providing a compensation system tailored to individual needs and desires will retain those most willing to serve.

Based on the criterion set forth by Hansen and Koopman (2005), the CRAM model proposed in this paper could have a scorecard similar to Figure 11.

Goals		Principles	
Combinatorial retention Auction Mechanism			
Recruit	Yes: individuals who place a high value on non-monetary compensation will be most interested in the Navy	All Volunteer	Yes.
Retain	Yes: individuals who place a high value on non-monetary compensation will be most interested in the Navy	Flexible	Yes: Memebers would choose the benefits they desire most. Would require flexible budgeting of SRB allocation.
Attain High Performance	Somewhat: individuals who obtain critical/technical skills will be highly rewarded. Must be retention eligible. However, higher rank often coincides with lower SRB.	Best Value	Yes. By substituting cash payments for non-monetary benefits and allocating those Incentives only to those who value them more than they cost.
Reward Exceptional Performance	No.	Support Objectives	Yes.
Assign	No.		
Motivate Development	Somewhat: individuals who obtain critical/technical skills will be highly rewarded.		
Facilitate Transitions	Possible: if sabbatical, on/off ramps offered as incentives.		

Figure 11. Projected CRAM Scorecard (After Military Compensation Reform)
(Hansen & Koopman, 2005, Appendix C)

The CRAM Model will address the strategic goals of *Recruit* and *Retain* by showcasing the abundance and variety of benefits available to service members. It will be a highly *Flexible* and responsive tool that will adjust easily and readily to changing labor supply and demand conditions. It will provide strategic *Best Value* to the Navy by ensuring considerable Sailor value while also being more cost effective than the current compensation policies.

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IV. Surface Warfare Officer and Enlisted Sailor Retention Surveys

To test the hypothesis—offering non-monetary incentives in a total rewards, flexible benefits package would be the most efficient method of achieving the Navy's retention objectives—it was necessary to determine the value Surface Warfare Officers and Enlisted Sailors placed on those incentives. To determine these values, surveys were designed and administered to both populations throughout the fleet. To mitigate issues in the enlisted retention survey, such as first-term obligation length, training intensity and length, minimum recruiting criterion, civilian opportunities, and SRB levels, the Enlisted Retention Survey focused on two Navy enlisted ratings rather than on the entire enlisted population.

A. Surface Warfare Officers

Surface Warfare is the Navy community that uses surface ships for the missions of forward naval presence, sea control and projection of power ashore. The Surface Warfare community is the oldest community in the Navy and today comprises just over 8,000 officers (Graham, 2006). Surface Warfare Officers are the fleet's —ship drivers” that operate surface ships at sea, including managing all the onboard systems and personnel. It is their job to lead the ship into harm's way when so directed by higher authority. The pinnacle of a Surface Warfare Officer's career path would typically be to command a ship at sea.

Like all other naval officers, the Surface Warfare Officer typically comes into the Navy with a four-year college degree. Most of these junior Surface Warfare Officers go directly to sea after graduating from their undergraduate institutions, serving their first tour division officer job when they arrive. The SWO division officer tours are designed to provide the hands-on training and development necessary for the new officers entering the fleet. Division officer tours are typically 24 and 18 months for 1st and 2nd division officer tours, respectively.

Upon successfully completing their two afloat division officer tours, they have the opportunity to rotate to shore duty and pursue a variety of interests, which may include pursuing a graduate degree, working in a staff position or working as a recruiter. This time ashore is designed to further broaden the experience of young SWOs, as well as provide them additional education and training as they prepare to return to the fleet as Department Heads afloat.

Today, the Navy's primary concern with the Surface Warfare Officer community is how to continue to retain the necessary quality and quantity of officers past their initial obligations to ensure there are sufficient Surface Warfare Officers available to fill all the Department Head jobs that exists across the fleet. Typically, junior SWOs reach the end of their initial obligated service period while on their second afloat division officer tour or, at the latest, on their first shore tour. Most of these officers must make critical career decisions on whether to stay in the Navy or look for a career in the civilian sector. Many decide to get out of the Navy at this point; others may try to make a lateral transfer to another community, while some decide to continue in their SWO career path.

During the past 10 years, the Navy has faced a shortage of Surface Warfare Officers at the Department Head Level. To increase the SWO retention rate into their Department Head Tours, the Navy implemented the Surface Warfare Officer Continuation Pay (SWOCP), a special pay designed to incentivize those personnel eligible to pursue their SWO careers as afloat Department Heads. Upon acceptance of the SWOCP, the officers must commit to completing Department Head School, followed by two back-to-back 18-month Department Head tours afloat.

1. SWO Retention Survey

For the SWO survey, Denmond et al. (2007) first surveyed Surface Warfare Officers currently attending the Naval Postgraduate School (NPS). The survey consisted of 18 questions and took approximately 15 minutes to complete. The primary target groups for the survey are those Surface Warfare Officers who have or have not completed their initial division officer tours and have not yet signed a

contract accepting a retention bonus or submitted a request for resignation from active duty. The survey included basic demographic questions, such as ethnicity, commissioning source, number of dependents, and the highest level of education completed. Their research used a web-based survey using SurveyMonkey. Based on the geographical dispersion of our sample audience and their corresponding relative ease of access to the internet (in most cases), this survey method proved to be the most appropriate for our purposes. SurveyMonkey is a licensed survey web engine utilized by the Naval Postgraduate School. The survey was distributed, collected, and completed anonymously by the following designated groups:

Table 1. Web-based Survey Open/Close Dates

Sample Group	Survey Open Date	Survey Close Date
<ul style="list-style-type: none"> • NPS Students • Junior SWOS afloat 	<ul style="list-style-type: none"> • 26 JUL 2007 • 13 AUG 2007 	<ul style="list-style-type: none"> • 10 AUG 2007 • 25 AUG 2007

The survey was distributed via e-mail to the Naval Postgraduate School Surface Warfare Officers during the summer quarter of academic year 2007. These officers were given two weeks to complete the survey, with reminder e-mails sent at the end of the first week and two days prior to the survey deadline. The survey was also distributed to junior SWOs serving on ships throughout the fleet. In both cases, the survey audience was notified of the survey via e-mail. The students at NPS were requested to take the survey by the senior SWO at NPS.

For the afloat units, e-mails were sent by Professor Gates (then Associate Dean for Research in the Graduate School of Business and Public Policy at the Naval Postgraduate School), in coordination with the project team, to 110 Commanding Officers serving on afloat units. The ships chosen for the survey were platforms on which typical junior SWOs serve for their first and second Division Officer tours. Ship types included: Frigates (FFG), Destroyers (DDG), Cruisers (CG), Dock Landing Platforms (LPD), and Dock Landing Ships (LSD). They are located in a variety of fleet concentration and deployed locations to include Norfolk,

San Diego, Yokosuka, Bahrain, Jacksonville, Pearl Harbor and Everett.

Commanding Officers were asked to distribute the survey description and web link to their junior officers; however, they themselves would have no visibility over the individual responses of the officers under their command. It was noted in the survey that participants would be allowed to view the results upon the completion of the survey research. The e-mail text is as follows:

Commodores, Commanding Officers, and Executive Officers,

As Associate Dean of Research for the Graduate School of Business and Public Policy at NPS, I am advising a group of MBA project students looking at the SWO retention bonuses. This comes out of the work that NPS did last year that found the SWO retention rates very low, particularly for female officers. As a result of that work, and the life-work balance conference at NPS, we are interested in looking at multi-attribute SWO retention bonuses (money plus homeport, etc.). Our intended audience is all Surface Warfare Officers O-3 and below who have not accepted the SWOCP.

As a first step, the students hoped to survey SWOs to see how they would respond to non-monetary bonuses. I have attached the survey for your information. The idea is to use the survey results in a simulation model to come up with a (very) preliminary estimate of the cost-effectiveness of this idea. In the future we are looking at combining this work with the on-going research we have on bonus auctions. I can give you more details if you are interested. I will be on leave, with limited e-mail access through Aug. 20. If there are any questions regarding this survey, feel free to contact the students copied on this e-mail by replying to all.

I would greatly appreciate your assistance in getting this survey out to your Junior officers. The survey link is listed below:

http://www.surveymonkey.com/s.aspx?sm=P60phnT96MRwK6qzb6yvGA_3d_3d

The survey will be closed on August 25th.

In trying to determine survey response rates, the authors were unable to identify the exact number of officers in each of the sample sizes. The response rate is the proportion of all participants selected who completed the survey (Keller, 2005). The authors were not able to identify how many lateral transfers from the SWO community were attending NPS; some may not have received the survey. In

regards to the junior shipboard SWOs, the authors were unable to determine just how many officers were onboard each ship that fit the eligibility criteria for survey completion (O-3 and below who have not yet signed on for SWOCP), or how many actually received the survey. The authors used the known wardroom size for each ship type, assuming 100 percent manning, to estimate the approximate sample size and to calculate a response rate. Table 2 provides estimates response rates.

Table 2. NPS and Fleet Survey Results Total

Survey Group	Sample Size (Approximate)	Number of Responses (Actual)	Overall Response Rate (Approximate)
NPS SWO Students	180	53	29 %
Junior SWOs afloat	1200	260	22 %

According to statistics, specifically the Central Limit Theorem, for any sample size with $n \geq 30$, where n represents the sample size of the population in question, we can accurately use our findings to make predictions about the population (Keller, 2005). In this project, we have sample sizes equal to or greater than 30 in both instances, with NPS students totaling 53 and SWOs afloat totaling 260; in both cases, we are able to make accurate predictions about the population. While the NPS student survey provided a useful cross reference, it will not be analyzed further here; the NPS respondents have agreed to be retained as SWOs, so they are not a representative sample.

Of the 260 responses from junior SWOs afloat, 105 stated that there was no amount of money that would induce them to retain. They were excluded from this analysis. Officers whose base monetary bids exceeded \$200,000 were also excluded. Many bids in this category were seven figures or more, likely indicated an unwillingness to retain. Furthermore, there is a \$200,000 Title IX cap on officer

bonuses. After removing these respondents, there were 144 legitimate bids. These respondents were used in this analysis.

5. Summary of Enlisted Retention Survey Responses

Table 3 lists the average reservation values for a purely monetary reenlistment bonus and the dollar amount of that bonus the respondents would be willing to give up in exchange for a particular incentive. The values in Table 3 exclude bids in excess of \$200,000.

Table 3. Average Reservation Values for Respondents

SRB Required	\$ 105,077
Homeport	\$ 10,617
Ship	\$ 3,654
Billet	\$ 7,210
One Year Sabbatical	\$ 11,235
Telecommuting	\$ 11,373
Geographic Stability (2 tours)	\$ 11,760

All Willingness to Pay (WTP) values for the nonmonetary incentives were less than SRB requirements stated by that respondent. This indicates some consistency in reporting. Combined incentive values were less consistent. The value of two or more incentives in combination sometimes exceeded the sum of the individual values. This indicates complementarities between or among the combined incentives. Often, the value of two or more incentives in combination exceeded the highest individual value, but did not equal the sum of the individual incentives. This indicates a possible diminishing marginal value to each additional non-monetary incentive or a substitution effect between or among the incentives within the combination.

In approximately 18% of the responses, the reported value of two or more incentives in combination was below the value of the most highly valued individual incentive in that combination. While unusual, there are many reasons why such reported combination values may have occurred. There may have been a significant negative interaction among the incentives included in the combination. For example,

a Sailor might have been interested in ship or billet type separately, but perhaps his particular situation made choice of ship and billet type particularly unappealing. More simply, perhaps the respondent just forgot how the incentives had been valued in previous questions, or the respondent grew tired and rushed through those final questions. Chapter VI discusses how such unusual responses were addressed.

B. Enlisted Communities

The Air Traffic Controller (AC) and Fire Controlman AEGIS (FC AEGIS) ratings were selected by the research sponsor for the Enlisted Retention Survey based on each community's size and retention challenges. The Department of the Navy indentified these ratings as two of the twenty —most undermanned critical skills" (DoN, 2008). The Naval Personnel Command provided the following information about the AC and FC ratings:

1. Air Traffic Controller

Navy Air Traffic Controllers (AC) perform duties similar to civilian air traffic controllers and play a key role in the effective use of Naval airpower throughout the world in operational and training environments. Navy ACs are responsible for safely and effectively directing aircraft operating from airfields or the decks of aircraft carriers. They also control the movement of aircraft and vehicles on airfield taxiways and issue flight instructions to pilots by radio. Standards for entry into the AC field are high, but once accepted into the field, Navy ACs enjoy a demanding and highly rewarding career. This is a five-year enlistment program. (Otten, 2008, November 18)

2. Fire Controlman

Only two Navy job specialties, called "ratings," are included in the Advanced Electronics/Computer Field: Electronics Technician (ET) and Fire Controlman (FC). The rating in which an Advanced Electronics/Computer Field candidate is trained is determined in the initial phase of the Advanced Electronics Technical Core Course in Great Lakes, Ill. However, eligibility requirements are the same for both ratings in the Advanced Electronics/Computer Field.

Jobs performed by [...] FCs are performed throughout the Navy's fleet of surface ships including aircraft carriers and Aegis cruisers, and at repair activities ashore [...].

FCs operate, maintain and repair the Fire Control Radars, mainframe computers, large screen displays, LANS, weapon control consoles, automatic

gun systems and associated electro-mechanical systems utilized in weapons systems.

These ratings comprise the basis of the ship's Combat Systems department aboard ships and are responsible for maintaining the ship's readiness for combat operations. (Salter, 2008, November 6)

While the AC and FC ratings are vastly different in terms of duties and responsibilities, they are comparable with respect to initial obligation length, intensity of training, and quantity of civilian employment opportunities.

3. Population Statistics

There were 2,306 ACs at the time of the survey, 20.4% of which were female. There were 2,115 E-6 and below, and 29.7% of the rating's billets were at sea. Of the 2038 FC AEGIS personnel, only 6.4% were female. There were 1,733 E-6 and below, and 76.7% of the rating's billets were at sea. There were 4,032 Non-AEGIS FCs in the fleet—of which 8.9% were female, and 62.7% of these billets were at sea (Ferber, 2008, July 18). The AC and FC ratings provide an excellent contrast to each other in terms of the above demographic characteristics. Due to the relatively small size and 15% expected response rate, the researchers chose to distribute the survey to the entire population (including non-AEGIS FCs).

Because of the second-hand nature of contacting the Sailors, a response rate was difficult to determine. Dependent on the number of Sailors actually contacted, response estimates ranged from 8.6% to 11.5%. Although the response rate was relatively low (Kraus et al., 2003, p. 31), there was a fairly representative sample. Table 3 shows a comparison of the population versus the sample in key demographics. Hispanics were considerably over-represented in the FC (AEGIS) rating. Air Traffic Controller was under-represented at sea, and Fire Controlman was over-represented.

Table 4. Population and Sample Statistics

	AC		FC (non-AEGIS)		FC (AEGIS)	
	Population	Sample	Population	Sample	Population	Sample
Female	20.81%	21.62%	8.93%	11.76%	7.50%	11.80%
Black	23.59%	22.27%	10.97%	8.11%	11.45%	12.57%
Hispanic	15.62%	9.55%	1.36%	5.95%	10.62%	10.18%
Under 27	59.66%	57.14%	48.45%	58.82%	46.13%	54.80%
28-42	37.96%	42.38%	47.73%	39.57%	49.83%	42.94%
Over 42	2.38%	0.48%	4.27%	1.60%	4.34%	2.26%
E6 & below	92.11%	97.76%	82.49%	96.79%	85.39%	95.51%
E-5	37.20%	41.70%	34.76%	54.55%	40.43%	51.12%
E-4 & below	30.35%	19.28%	24.39%	17.11%	14.52%	11.80%
At sea	29.29%	19.00%	62.72%	98.26%	72.54%	90.51%

1. FC(NON-AEGIS) significantly under-represented (Hispanic)
2. Due to targeting of E-6 and below, under-representation expected
3. AC under-represented and FC over-represented (at sea)

In the sample, the extremely low percentage of age 42 and above reflects the specific targeting of Sailors E-6 and below.

4. Enlisted Retention Survey

Unfortunately, Naval Personnel Command (NPC) was only able to provide approximately 50% of the e-mail addresses for personnel with those ratings. Potential subjects were contacted through the available individual e-mail addresses. To ensure maximum contact, approximately 150 Command Master Chiefs were also sent e-mails requesting that they forward the survey invitation (below) to their respective Petty Officers First Class (E-6) and below ACs and FCs (AEGIS and non-AEGIS):

Subj: Survey Invitation from the Naval Postgraduate School

INVITATION TO PARTICIPATE:

You are cordially invited to participate in the Naval Postgraduate School's Non-Monetary Retention Incentives Survey. This survey will allow you to give us important feedback regarding non-monetary benefits such as geographic stability, telecommuting, compressed workweek or guaranteed homeport as well as an opportunity for you to give "write-in" suggestions. The survey's main focus is to assess how much you would value the included non-monetary benefits if they were offered as a part of your reenlistment package.

If you receive this invitation from more than one source, we apologize. We are sending these invitations through multiple avenues to ensure everyone gets a voice! Please only take the survey once. Thank you in advance for your participation!

Survey closes 11 Jul 08. Please click on link:
http://www.surveymk.com/s.aspx?sm=m3GQ9plp63OmH52DN8N0Bg_3d_3d

The survey was available via Surveymonkey from June 24, 2008, until July 11, 2008. The entire survey is included in Appendix B.

5. Summary of Enlisted Retention Survey Responses

There were 688 completed surveys. Only 604, however, were usable. The deleted observations were missing crucial data (i.e., reservation values). It was not possible to infer this data from the other available information. Derived numbers were contained in 17 observations.²

Table 5 lists the average reservation values for a purely monetary reenlistment bonus and the dollar amount of that bonus the respondents would be willing to give up in exchange for a particular incentive. The values in column 1 include outliers (initial values in excess of \$500,000³) and currently infeasible amounts (in excess of \$150,000⁴). Column 2 excludes outliers and Column 3

² Of these individuals, 15 indicated that they would reenlist for free (no SRB). They proceeded, however, to indicate a willingness to pay (WTP) a percentage of their SRB for the non-monetary incentives listed. We inferred that they were aware of their eligibility for an SRB and were basing their WTP percentages on this amount. SRB amounts, for calculation of WTP only, were derived from demographic information provided. The Navy's online SRB calculator (<https://staynavytools.bol.navy.mil/SRB/Default.aspx>) was used. SRB amounts for these individuals were entered as zero. The remaining 2 individuals indicated that they would require the "current SRB" to reenlist. Their SRB amounts were derived using the above link.

³ Values above \$500,000 seemed to indicate that no amount of money would entice the respondent to reenlist. There were only three responses in this category: \$500,000, \$1,000,000, and \$10,000,000. These observations significantly skew the summary statistics and are considered true outliers.

⁴ Although current maximum SRB amount can not exceed \$90,000 (Chief of Naval Operations, 2007), the researchers chose \$150,000 as a maximum feasibility level to ensure future viability of this analysis.

excludes infeasible requirements. All usable responses, except one,⁵ were included in the thesis simulations.

Table 5. Average Reservation Values for Respondents

	All Usable Responses	Outliers Excluded	Outliers and Infeasible Excluded
Number of Observations	603	600	592
SRB Required	\$66,779	\$47,978	\$45,539
Homeport	6,498	6,358	6,302
Platform	11,477	2,563	2,594
Billet	14,039	5,357	5,358
One Year Sabbatical	4,706	4,731	4,772
Telecommuting	6,711	5,862	5,730
Geographic Stability (2 tours)	4,609	4,633	4,592
Geographic Stability (3 tours)	6,763	6,620	6,707
Professional Certification	3,608	3,627	3,579
Compressed Work Week	3,289	3,307	3,309
Transferrability of GI Bill	6,778	6,814	6,901
Single Barracks Room on Sea Duty	628	631	641
BAH on Sea Duty	1,433	1,440	1,443
Lump Sum SRB	4,400	4,424	4,441

With the exception of one value entry, all Willingness to Pay (WTP) values were less than the stated SRB requirements. This again indicates some consistency in reporting. As before, combined incentive values were less consistent. The value of two or more incentives in combination sometimes exceeded the sum of the individual values. At other times, the value of two or more incentives in combination exceeded the highest individual value but did not equal the sum of the individual incentives. Finally, in approximately 30% of the responses, the reported value of two or more incentives in combination was below the value of the most highly valued individual incentive in that combination. Again, while unusual, there may be a significant negative interaction among the incentives included in the combination.

⁵ Respondent 623144606's responses were deleted. The Sailor's SRB requirement (\$10,000,000) and two NMI values (\$5,000,000 each) significantly skewed results.

Use of the mean to determine central tendencies can be misleading in non-normal distributions. In both surveys, many of the value distributions for the non-monetary incentives have large clusters at zero dollars, smaller clusters at certain “focal” values, and long right-hand tails with few high values. This is shown in Figure 12.

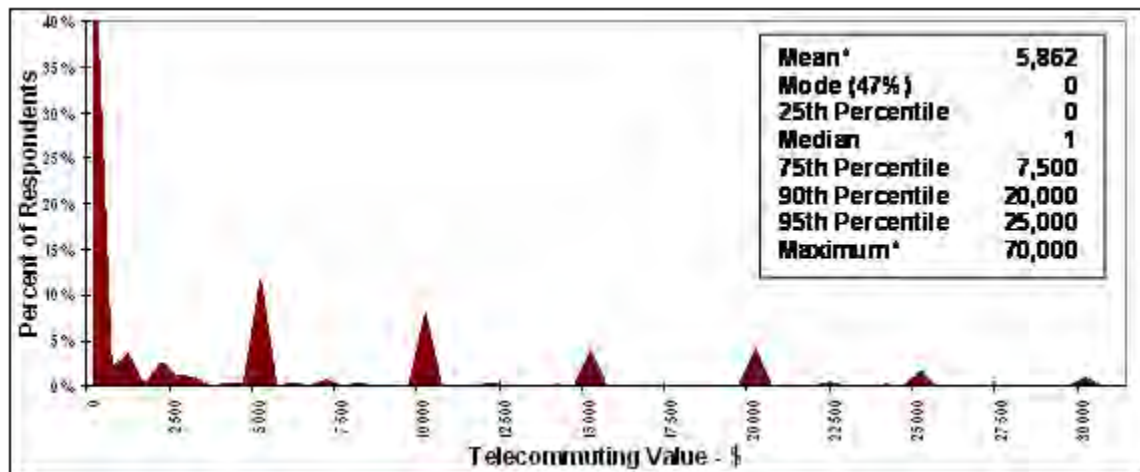


Figure 12. Value Distribution for Telecommuting—Enlisted Survey

Because of this asymmetric distribution of values, a simple report of means and standard deviations does a poor job of describing the distribution of values associated with any particular non-monetary incentive. Consequently, Tables 6 and 7 display the 10th, 25th, 50th, 75th and 90th percentile values for the SWO and enlisted surveys, respectively, to more accurately describe the value distribution for each incentive. It is also advantageous to describe the distributions of values this way because the simulations, which this research describes later, used different percentiles of the value to estimate costs. Appendix C contains value distribution figures for all non-monetary incentives from both surveys.

Table 6. Reservation Value Percentiles—SWO Survey

	Percentile				
	10th	25th	50th	75th	90th
SRB Required	\$50,000	\$75,000	\$ 100,000	\$ 150,000	\$ 150,000
Homeport	0	0	5,000	15,000	25,000
Ship	0	0	0	5,000	10,000
Billet	0	0	1,000	10,000	20,000
One Year Sabbatical	0	0	1	20,000	36,000
Telecommuting	0	0	1,000	20,000	40,000
Geographic Stability (2 tours)	0	0	5,000	20,000	30,000

Table 7. Reservation Value Percentiles—Enlisted Survey

	Percentile				
	10th	25th	50th	75th	90th
SRB Required	\$10,000	\$25,000	\$45,000	\$70,000	\$89,000
Homeport	0	0	5,000	10,000	20,000
Platform	0	0	0	2,136	10,000
Billet	0	0	2,000	10,000	15,000
One Year Sabbatical	0	0	0	5,000	15,000
Telecommuting	0	0	1	7,500	20,000
Geographic Stability (2 tours)	0	0	0	5,000	12,800
Geographic Stability (3 tours)	0	0	1,000	10,000	20,000
Professional Certification	0	0	0	5,000	10,000
Compressed Work Week	0	0	0	5,000	10,000
Transferrability of GI Bill	0	0	1,000	10,000	20,000
Single Barracks Room on Sea Duty	0	0	0	0	500
BAH on Sea Duty	0	0	0	0	5,000
Lump Sum SRB	0	0	0	5,000	10,000

One immediate and striking characteristic revealed in Tables 6 and 7 is that both the 10th and 25th percentiles of the distribution of reported values for every non-monetary incentive is zero. This means that for each non-monetary incentive, at least 25% of all respondents saw no value in that particular incentive. In 11 of the 19 NMIs analyzed across both surveys, the median respondents reported a value of zero or \$1. In two cases, more than 75% of the respondents reported a zero value for the NMI (BAH on sea duty and lump-sum SRB for the enlisted community).

It is also relevant to note that there were 54 reported NMI values that were not usable. This is because it was not possible to infer values based on the respondents' answers. For example, "this would never happen" seems to imply that the respondent values the option but doesn't believe it is feasible. Some respondents put actual choices, such as "San Diego" for the homeport option, but failed to indicate a dollar amount they were willing to pay. Again, this implies some value but not a specific amount. These values were assumed to be zero to include the respondent's other choices. There may be, however, some minor bias introduced into the model due to these discrepancies.

Note, however, that any bias introduced by assigning a zero value to these answers works in favor of the strictly monetary retention incentives. Further, it works against the two non-monetary incentive options examined in this study (the universal incentive package and the combinatorial retention auction mechanism). Thus, the cost savings calculated in this study actually understate the true cost savings that could be achieved by effectively incorporating non-monetary incentives into the Navy's retention offers. Nonetheless, the ultimate impact of assuming zero value for these answers is likely minor, as these 54 values account for less than 0.4% of the 15,289 reported NMI values. These 54 responses came from 26 different respondents, or 3.5% of the sample.

2. Reasons for Accepting or Rejecting the SRB

Respondents in both surveys were asked to provide an open-response answer why they might accept or decline an SRB, if offered. The responses ranged from insightful, well-articulated ideas to frustration over policies and perceptions. There were, however, categories of responses that warrant further discussion.

a. SWO Survey

There were several recurring attitudes that junior SWOs expressed during the survey. These themes can be grouped into the following categories:

1. Lack of family time, work-life balance issues, excessive work hours

2. Poor command climate, micromanagement
3. Threat of Individual Augmentation (IA) assignment
4. Overall job dissatisfaction

Many SWOs felt that command leadership has no regard for their personal well-being or morale. These officers felt that Department Head tour commitments would make it difficult to be present for major personal/family milestones such as vacations, family reunions, weddings, class reunions, births and funerals. The survey also indicated SWOs were dissatisfied with the command culture and felt that their assigned tasks were repetitive and offered no chance for individual initiative. They also expressed concern about IA deployments. Aviation and staff corps community cultures are more appealing to junior SWOs because of the high stress in the Surface Warfare Officer Community. Overall, junior SWOs felt that they have to work excessive hours, fill stressful sea duty billets and must have a senior mentor who can assist them with the detailing process in order to be successful.

b. Reasons for Accepting the SRB—Enlisted Survey

Figure 13 summarizes the distribution of the most common reasons for the enlisted respondents accepting the SRB.

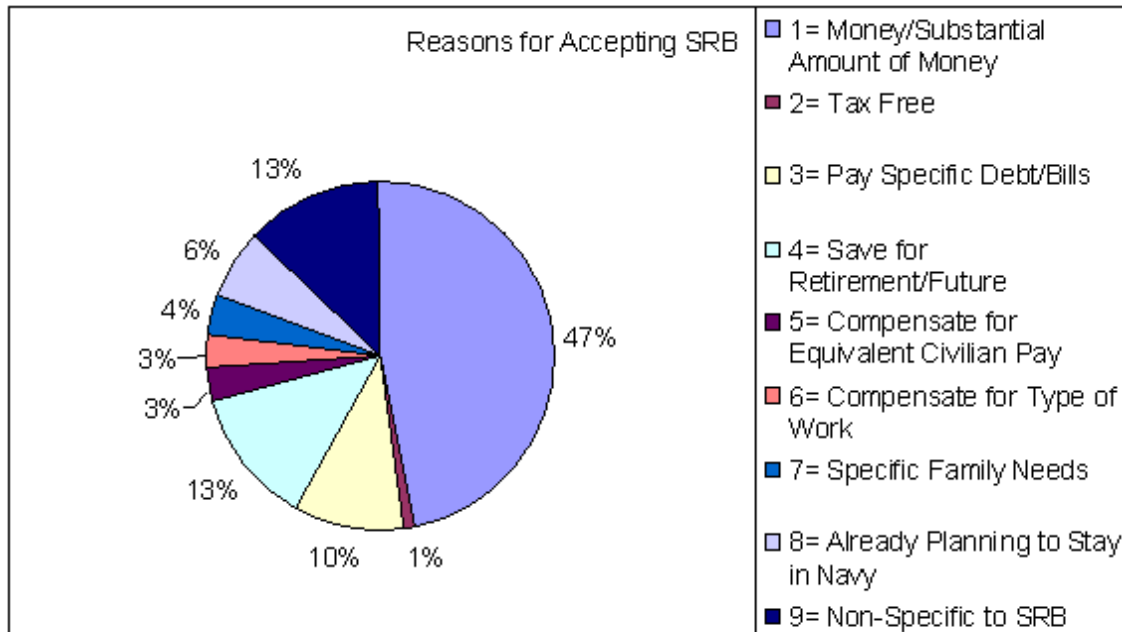


Figure 13. Reasons for Accepting the SRB

“The Money”

Almost half (47%) of those who answered indicated that —money,” or the size of the bonus, was their primary reason for accepting the SRB. The tone, however, of these responses suggests that there may have been other factors that influenced this decision, but the question wording was unclear. For example, respondent 623952540 states, —don't know why I wouldn't accept it. It's one of the reasons I would be reenlisting.” Many also included a non-monetary reason, such as respondent 622991201, who noted, —It ~~as~~ for 75,000 and I enjoy what I do,” or respondent 621771622 who wrote, “The amount of money, but would also like geographic location.”

Other Cash-related Reasons

Almost 33% of the responses fell into the following categories: to pay a specific/debt or bills (9.9%); to save for the future/retirement (12.8%); to compensate for equivalent civilian pay (3.2%); to compensate for type of work performed (2.8%);

and specific family needs (4.1%). While these reasons indicate the expected use of the bonus, many could feasibly be satisfied with non-monetary compensation.

For example, respondent 621185813 states, “[P]ay off bills quickly and maintaining health insurance and life insurance from the government.” This indicates that the respondent intended to use the SRB to pay off bills in a timely manner, but may have reenlisted for the medical and life insurance benefits.

“I love the Navy”

Just over 6% said they were planning to reenlist anyway and that the bonus was an added benefit. This indicates significant economic rent or surplus is being paid to these individuals, as 57% of them are FCs who currently receive substantial SRBs. For example, respondent 622007241 “W]as going to stay in anyway. Bonus was an extra incentive.” Some did, however, indicate they believed the SRB kept them on par with their civilian counterparts. Respondent 623273057 stated, “I already love my job and this is incentive for me not to go to the civilian sector and make more money.”

Other Reasons

Almost 13% of respondents indicated that their reasons for reenlisting were non-monetary. These covered a wide variety of reasons, including medical, dental and retirement benefits, job stability, liking the Navy, enjoying one’s job, duty location guarantee, shore duty, advancement opportunities, pride in service. One individual indicated he was reenlisting for the opportunity to go to sea!

c. Reasons for Declining the SRB—Enlisted Community

Figure 14 summarizes the distribution of the most common reasons for the enlisted respondents declining the SRB.

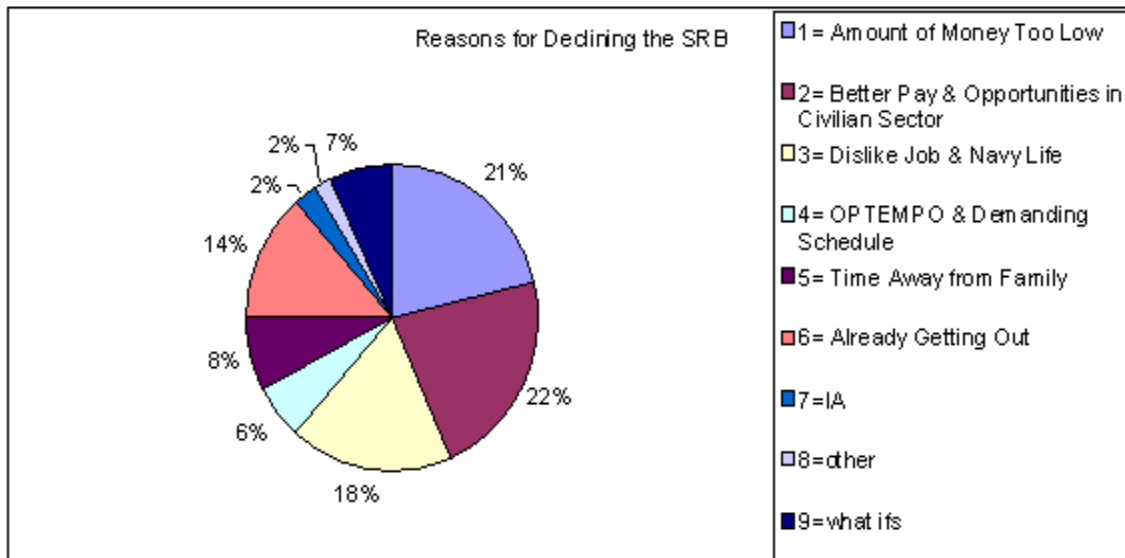


Figure 14. Reasons for Declining the SRB

Civilian Opportunities

The most popular reason for declining the bonus was better opportunities or pay in the civilian sector. Of those who answered this way, 59% were FCs. This suggests that there is still a perceived pay-gap beyond that which the SRB attempts to compensate.

“The Money”

Only 21% of those who answered the question indicated that they would not accept the SRB because the amount was too low. Combining this group with those who referenced better civilian opportunities or pay, as described in “Civilian Opportunities,” leaves 57% whose reported reasons for not reenlisting were not directly pecuniary. Therefore, these might be addressed via non-monetary incentives.

“I don’t like this place”

Just over 18% of respondents indicated they were unhappy with aspects of their jobs or Navy life. Respondent 621725008 states, —do not enjoy military life. Most of my time is not actually spent working with electronics. I am a highly trained

individual who spends most of his time cleaning instead of troubleshooting the weapon system.” This same individual indicated that he would accept the SRB because it —~~as~~ a good amount of money, the Navy has been good for me and my family.” These responses indicate that, for this individual, money is not the primary driver for retention.

“I’m getting out”

Almost 14% of respondents gave no specific reason, but indicated that they would not be reenlisting. It is unclear from the results if some of these individuals were unwilling or unable to reenlist because they simply answered —I ~~w~~ not be reenlisting” or words to that effect. Of those who meant they were unwilling due to some non-pecuniary compensation issues, perhaps these individuals could be retained through non-monetary incentives.

“What ifs”

Only 7% of respondents gave hypothetical situations in which they would not reenlist. For example, respondent 622066295 stated, —If at the time of re-enlistment, it is not worth staying in, in regards to family and personal time.” Respondent 622046321 stated, —If I am selected for an enlisted to officer program.” Others indicated if the amount was not enough, they would not reenlist, but did not specify that the current amount was too low. For example, —If I can't choose my orders and the sum is lower than I expected” (respondent 623904752).

OPTEMPO/PERSTEMPO

Dissatisfaction with sea/shore rotation, deployment schedules, and time away from family were primary reasons for 14% of respondents to decline the SRB. Almost 8% specifically stated time away from family as the primary reason. While high operations tempo (OPTEMPO) and subsequent family separation are necessities in the Navy, there may be an opportunity to retain these Sailors if they believe they are not excessive. Respondent 623140885's statement reflects a

common sentiment, “Due to cutbacks, ships are undermanned and that means even longer hours in port and less time with family.”

3. Respondent Retention Suggestions

Enlisted respondents were also asked to list any other non-monetary incentive(s) that the Navy could offer which would be attractive and the amount of bonus dollars they would be willing to give up to receive that incentive.

Figure 15 summarizes the most common responses from the enlisted community.

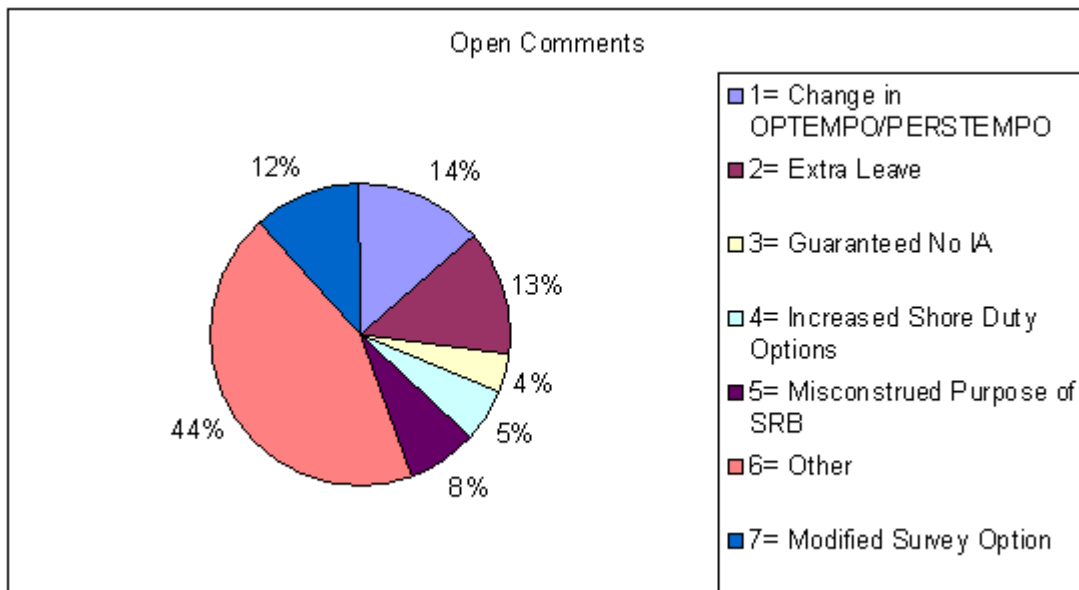


Figure 15. Open Comments

Over half of the responses fit into one of six basic categories. The remaining 44% proposed changes to the promotion system, structuring of billets, retirement policy, education opportunities, and current leadership. For example, respondent 621267862 stated:

Return the training commands to the military, who possess a clue about what is necessary to train Sailors rather than civilians who have no concept of shipboard life. Working knowledge of the gear is far more valuable than theory and experience on an actual platform surpasses a civilian's dry-side knowledge. Open the billets for training

back up for the Sailors who know the gear and how it really acts.
\$45,000 (all).

Respondent 621303137 stated, —Retire at 10 years service—\$60,000. Automatic advancement—\$40,000.” Respondent 621318214 suggested, “AD orders set aside for college and/or work toward college (9 mo/s - 1 year)—\$45000.” This is an interesting twist to the sabbatical idea and is similar to the former Enlisted Education Advancement Program. Respondent 621566154 gave multiple suggestions and feedback on our survey options and also expressed frustration with the current SRB policy:

I believe you need to seriously modify the current plan installed now for SRB. There are Sailors at my command that have been in for 4 years, do not have their Enlisted Surface Warfare Specialist Pin, do not have collateral duties, and are getting ready to reenlist for \$75,000 (tax free). Where is the logic in that? You are rewarding those who do nothing for you. I believe there should be a series of requirements to be able to receive amounts like this. As for your compressed work week, there is not enough time in the week now to get what we need done (I am a CIWS Tech) so I do not speak for all rates. Some of us do this [10-hr days] already 5/6 days a week and love our jobs. What kills our motivation is when the Navy gives and gives and gives to those who produce nothing. I am not a disgruntled Sailor and I plan on retiring. I did get \$45,000 a few years ago when I reenlisted, but I worked extremely hard for it. I do enjoy my job and appreciate what the Navy had offered me. Unfortunately, I am seeing way too many first class and chief petty officers getting out with 10,14,16 years of service. And the reason is because the Navy is changing.’ I do agree heavily on billet choice, geographic stability, and transferring of the GI Bill. These are the things we need to really consider. Making a Sailor and his family happy are key to morale at commands.

OPTEMPO/PERSTEMPO

Deployment schedule, sea/shore rotation, and time away from family continued to be of primary concern to these participants. 14% of those who answered gave a suggestion to improve these areas. Respondent 621751867 stated:

The main reason why I will not reenlist is due to the under-manning and increased demand while at sea. I have to do almost twice the

amount of work with almost half the manning from when I was on my first ship. I am not impressed or convinced the new “business model” for the Navy is effective. This is the military not a *Fortune 500* company. I have little time to pursue personal goals while on active sea duty where FC's have to be. The new ship's schedules are non-stop. It is possible to take PACE and distance learning classes, but time and internet constraints make it difficult. If our sea/shore rotation could be altered to allow FC's more time on shore to allow degree pursuits, professional certifications and spend more time with family. More quality training facilities need to be utilized for our new Sailors. Computer-based learning is not as effective as having a seasoned technician teach. The possibility to do back-to-back shore would also be a good incentive. Give people time to finish up a degree, raise a child, or simply take a break from the rigors of sea duty.

Extra Leave

Just over 13% of the respondents indicated they would like to purchase additional leave or liberty days in lieu of part of their SRB. Many gave dollar amounts that ranged from \$250 per day to \$10,000 for an increase to sixty days per year. These responses highlight another potential non-monetary incentive that is not currently being considered and has the potential to be a very cost-effective option.⁶

Modifications to Survey Items

Just under 12% of respondents offered suggestions that were similar to our survey items, but with modifications. For example, some indicated they would be willing to forgo some of their SRB for 6 months to a year to finish their degree, but on active duty versus on a sabbatical. Respondent 621309181 stated:

Guaranteed education benefits for reenlisting, i.e., reenlist, and the Navy will give the s/m the option of 12 months of paid college benefits at the end of the tour (to count as shore duty) s/m could work a shift schedule at recruiting station or other duty station or evening/weekend schedule—with no cap on the amount of hours to be taken within 12 month cycle; this could be very attractive to individuals who would like a fleet sabbatical to improve their education—just a thought—bonus

⁶ Per-day salary is \$180/day for a Sailor making \$45,000 per year. This assumes 5 days per week, 50 weeks per year.

reduction of \$7,500; designating parking would be an improvement—\$1000; compressed work schedule—\$1,000.”

Purpose of SRB

A small, but significant, number of respondents seemed to misunderstand the purpose of the SRB. Perhaps, because it is called a “bonus,” the perception is that it is some kind of reward for service. For example, respondent 622473320 stated, —[He] SRB for re-enlisting should be higher for those that have committed to doing a career in the Navy.” The reality is the exact opposite: the SRB should be lower—not higher—for those who have committed to a Navy career. This is because these are the types of Sailors who do not need to be paid much of a bonus to induce reenlistment. Instead, higher bonuses should be paid (must be paid) to those Sailors most reluctant to commit to a career in the Navy.

Respondent 623843938 stated, —I realize there is rank in the military, but I often find it disheartening and laughable that I receive the same paycheck as a second class BM who scrapes paint all day.” This individual is not factoring his SRB, that the Boatswains Mate (BM) does not receive, which significantly increases his wage above other Sailors of the same rank. Career counselors and leading Chiefs should continue counseling Sailors on their entire compensation package to ensure they truly understand the benefits they are receiving.

Increased Shore Duty Options

Over 5% indicated they would like to have better shore duty options. Almost 70% of those were FCs. The biggest complaint was that FCs are limited to Recruit Training Command, recruiting duty, or instructor billets in Dahlgren, Virginia.

Individual Augmentation (IA)

Although only 4% of the open responses mentioned IAs, it was also stated in 2% of the responses as the primary reason for declining the SRB and, thus, deserves discussion. Respondent 621567958 stated:

Shrink deployment times and get rid of IA requirements. We choose to join the Navy for many reasons, some of us love going to sea, patriotism, college money. However, I assure you, especially for those that have been in for more than 5 years, no one wanted and few a[re] willing to accept the challenge of a 6-18 month IA.

C. Summary

Although monetary compensation continues to be a significant motivator of retention, non-monetary aspects of military life are clearly important to these SWOs and Enlisted Sailors. The survey produced evidence of dissatisfaction with current benefits distribution and offerings and potential retention benefits from the proposed non-monetary incentives offered in this research.

Although many of the value distributions for the non-monetary incentives have a large cluster at zero dollars, there are smaller clusters at certain substantial ~~focal~~ values. The tails include a few high values (some as high as \$50,000 or more). These distributions underscore the challenges of applying a ~~one-size-fits-all~~ compensation package in terms of Sailor satisfaction and cost-effectiveness; they also provide evidence to support tailored retention packages designed to maximize the benefit to each individual Sailor while minimizing the cost to the Navy.

V. Retention Mechanism Alternatives

A. Introduction

As discussed in Chapter II, the current system of determining bonus levels is sub-optimal. Strength planners do not currently possess a tool that allows them to pinpoint the exact market-clearing bonus level. The result is either retention deficits or surpluses.

Moreover, despite budgeting more than \$350 million per year on retention incentives for enlisted personnel and a range of incentives for SWOs, including \$50,000 per officer for retaining through two Department Head tours, the Navy has, in recent years, failed to meet a number of its enlisted and SWO retention goals. Thus, it is also important to evaluate whether an alternative retention mechanism, beyond the strictly monetary incentives currently employed, might more cost-effectively achieve the Navy's retention objectives.

This chapter introduces several alternative mechanisms for (1) identifying precisely which personnel should receive a retention or re-enlistment bonus and (2) determining the appropriate magnitude and composition of such a bonus. These mechanisms include alternatives that employ strictly monetary incentives, as well as alternatives which incorporate non-monetary incentives into the retention bonus.

The next section describes mechanisms which utilize monetary incentives alone—either employing a pre-determined cash bonus amount or a cash bonus amount determined via auction. The final two alternatives involve non-monetary incentives incorporated into a Total Rewards package. For example, the Universal Incentive Package (UIP) combines a common monetary incentive with a common set of non-monetary incentives. Each is offered to all who are selected for retention or reenlistment. The concluding alternative is the Combinatorial Retention Auction Mechanism (CRAM). This combines individualized monetary incentives with packages of non-monetary incentives. These are —~~cost~~ customized” for each individual Sailor.

B. Monetary Retention Incentives Alone

The most straightforward approach to retention bonuses is to only use monetary incentives. Determining the appropriate magnitude of this monetary incentive, however, can be problematic. Generally speaking, the amount of the cash incentive can either be predetermined using various estimation techniques, or it can be determined endogenously via auction or some other market mechanism.

1. Predetermined Incentive Amount

As discussed in Chapter II, the size or amounts of the Selected Reenlistment Bonuses are predetermined using historical data combined with present economic conditions, such as unemployment rate and civilian-military pay gap. Unfortunately, as shown in Figure 16, this model is not a perfect predictor and can result in under-manning (or under-payment) in some ratings and over-manning (or over-payment) in others.

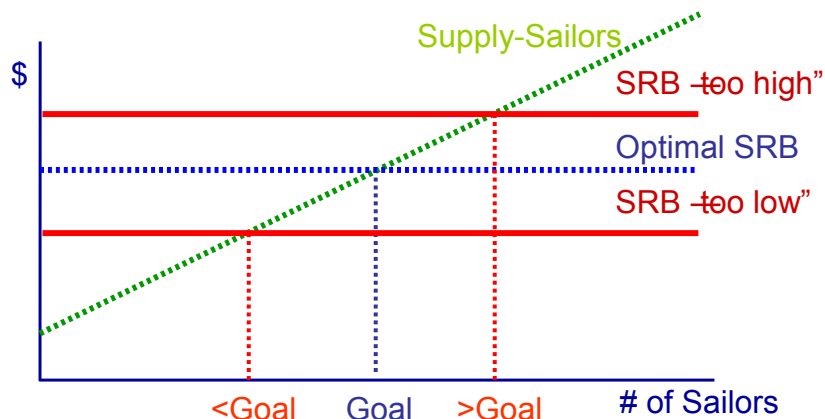


Figure 16. Disadvantages of a Predetermined SRB Level

2. Determined via Auction

A properly designed retention auction would inject accuracy into the SRB level setting process. Coughlan, Gates and Zimmerman (2008) argue that retention auctions offer the promise of being:

1. Precise:
 - a. Retain the precise number of service members desired.
 - b. Identify which individual service members to retain.

2. Cost Effective:
 - a. Endogenously determine minimum bonus necessary to achieve goals [...].
3. Voluntary:
 - a. Pay each retained service member no less than amount requested in bid for retention.
 - b. Exclude only those service members who requested more than (or at least as much as) amount paid to any retained service member.
4. Efficient:
 - a. Retain service members most willing to continue service. (Coughlan et al., 2008)

A key question, however, is which type of auction would best suit the Navy?

a. Open- vs. Sealed-bid Format

By necessity, a Navy retention auction would be a reverse, multiple-winner auction. The single buyer would be the Navy, and the sellers (of their labor) would be the Sailors. NPC (the auctioneer) would pre-determine the number of winners within each rating (or NEC) based on end-strength/manning requirements and budget constraints.

The simplest and most understandable variation would be the first-price, open-bid auction. It is, however, not feasible to simultaneously assemble all eligible Sailors (even virtually) to accomplish a real-time auction. The alternative is a sealed-bid auction. Therefore, a choice must be made between first- and second-price determination.

b. First-price vs. Second-price

To compare the first-price vs. second-price auction formats in the retention context, we must understand the bidding strategies under each format.

The optimal bidding strategy for a first price SRB auction is to inflate one's bid above the true reservation value, or minimum willingness to accept (WTA), to maximize economic rent received. Sailors must balance this strategy with the increased likelihood of "losing" the auction by overbidding.

In particular, the optimal bidding strategy for a risk-neutral bidder in a first-price reverse auction is to bid his estimate of the lowest WTA amount among the losing bidders. More precisely, if k Sailors will be retained within a particular rating, the equilibrium bidding strategy is for each Sailor to bid what he expects to be the $k+1$ st lowest WTA amount (conditional on the assumption that the bidder's WTA amount is among the lowest k WTA amounts).

In other words, the Sailors can expect that no Sailor will bid below his WTA amount. Thus, a Sailor is guaranteed to be one of the k —winners” in the auction so long as he bids below the $k+1$ st lowest WTA amount among the Sailors bidding. Thus, each Sailor is trying to bid as high as he can (above his true WTA amount) and still be a winner.

It is not clear, however, that Sailors will possess the requisite information on other Sailor WTA amounts to estimate the $k+1$ st lowest WTA amount. In the best case, bids will simply be inflated somewhat arbitrarily. In the worst case, the —wrong” Sailors (those less willing) will be retained. To retain them in subsequent auctions will likely result in higher retention costs.

For a second-price, *single-winner* auction, Chapter II demonstrated that truthful revelation is the only rational strategy. The same holds true—using a similar logic that will not be spelled out here—for second-price *multiple-winner* auctions. The problem with this type of auction is convincing less savvy participants that it is in their best interest to bid truthfully. Mandatory training and practice auctions would be necessary to ensure personnel understand their optimal strategy.

c. Cost Equivalence of Auction Types

With the bidding strategies under both the first-price and second-price retention auction articulated, it is important to note that the monetary cost of each type of auction is virtually equivalent. In all Enlisted Retention Auction formats, the Sailors who cost the Navy the least, or have the lowest willingness to accept (WTA), will be retained. If one assumes Sailors will not bid less than the minimum amount they would be willing-to-accept for retention, the only concern is with the possibility

of over-bidding to maximize economic rent. In Figure 17, the red line represents the optimal first-price auction bids, and the blue line represents second-price auction bids (in essence, these are the Sailors' true reservation values).

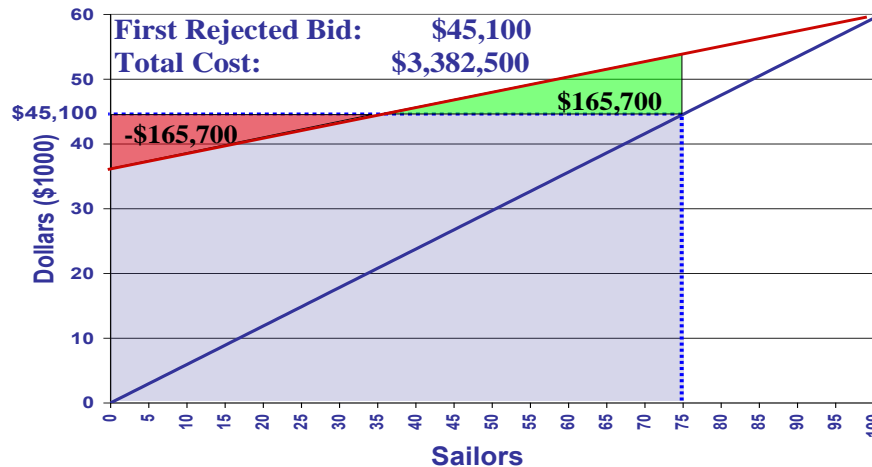


Figure 17. Cost-equivalence of First- and Second-price Auctions
(After Coughlan et al., 2008)

In the first price auction, the trade-off between risk of non-retention and the reward of economic rent determines the optimal strategy. A risk-neutral Sailor will bid what he assumes to be the lowest WTA amount among the losing bidders (conditional on his own WTA amount being among the winning WTA amounts). This results in an efficient mechanism: the Sailors who are most willing to remain on active duty are retained. Significant economic rent, however, is paid to those individuals who would have stayed for less. This is the distance between the red and blue line for each Sailor. Additionally, Sailors may have difficulty determining the proper bid. This may reduce the likelihood of retaining those most willing to remain in the service (Coughlan et al., 2008).

In the second-price auction example in Figure 17, the 75 cheapest Sailors are retained for the price of the 76th Sailor's WTA—in this example, \$45,100, for a total cost of \$3,382,500. The green triangle represents the Navy's reduction in bonus payments (to the highest WTA Sailors retained) over the first-price auction. The red triangle shows the Navy's increase in bonus payments (to the lowest WTA Sailors retained) over the first-price auction. These two numbers cancel each other, and the

result is the equivalent cost to the Navy under both mechanisms. What is not clearly equivalent is Sailor value. This model assumes that Sailors will accurately predict their optimum bid and place it accordingly. Sailors who would be retained under their true reservation values might incorrectly estimate their place in the distribution. Thus, they may overbid in the first-price auction and not be retained.

3. Second-price Retention Auction Example

Suppose the Navy wishes to retain two out of three Sailors who bid their true reservation values of \$80,000, \$90,000, and \$100,000, respectively. Under the second price auction mechanism, Sailors 1 and 2 would be retained for \$100,000 each for a total cost of \$200,000. Sailor 1 would receive a surplus of \$20,000, and Sailor 2's surplus would be \$10,000. This example will be further developed in Section D.3 to include the Combinatorial Retention Auction Mechanism.

C. Universal Incentive Package (UIP)

1. Description and Purpose

The simplest way to incorporate non-monetary incentives (NMI) is to offer a —one-size-fits-all” package that combines a predetermined portfolio of NMIs coupled with a cash bonus. To reach retention goals more efficiently than with money alone, the cash payments must be reduced sufficiently to cover the cost of providing the NMIs. If the Sailors value these NMIs more than the Navy's cost to provide them, the total value delivered to Sailors exceeds the cost of delivery.

The participants would be offered a fixed package of incentives and would submit a cash (requirement) bid to supplement that package. The auction would then follow the same process as the monetary-only auction.

2. Determining which Incentives to Include

The main difficulty when designing a Universal Package is determining which incentives to include. There will be a surplus to the Navy for NMIs where Sailor value exceeds cost and a deficit associated with NMIs where Sailor value is less than cost (see Figure 18).

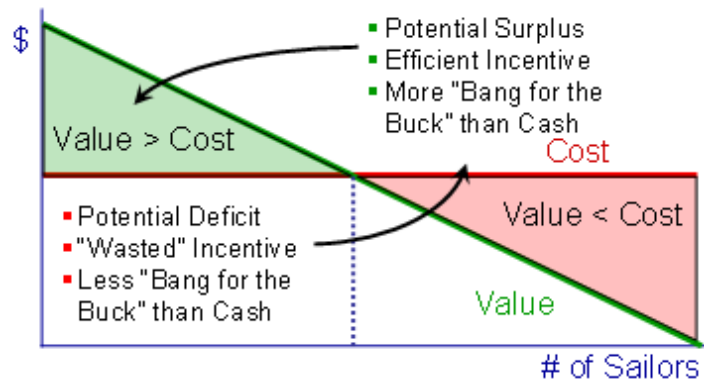


Figure 18. Cost vs. Value of Non-monetary Incentives
(After Coughlan et al., 2008)

Since all who desire the incentive will receive it, there is potential for significant deficit to the Navy in offering incentives whose cost exceeds the majority of Sailor values. In Figure 19, if the demand curves shown represent valuations among retained Sailors, it would be cost effective to offer choices a and b. This is because total Sailor value exceeds cost. Choices c and d, however, would result in a deficit. This is because total Sailor value is less than total cost.

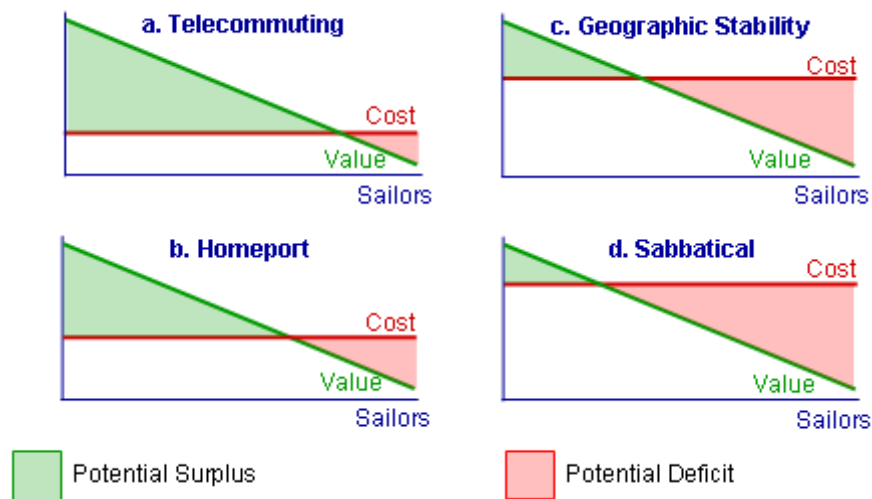


Figure 19. Non-monetary Incentives Portfolio
(After Coughlan et al., 2008)

3. Optimal Universal NMI Package

a. Description

Providing an NMI as part of a retention bonus package reduces each Sailor's minimum cash retention bonus required by the value of that particular NMI to that particular Sailor. Including a particular NMI as part of the Universal Incentive Package will reduce total Navy retention costs only if the total surplus among retained Sailors (value – cost summed over all retained Sailors with value > cost) exceeds the total deficit (cost – value summed over all retained Sailors with value < cost) for that NMI. More directly, the optimal Universal Incentive Package for the Navy would only offer those incentives for which the surplus exceeds the deficit (among retained Sailors).

b. Problem: Truthful Revelation

At the time retention decisions (and potential auction bids) are made, the incentive package must already be determined. Thus, to construct the optimal Universal Incentive Package, planners must discover the value distribution of prospective incentives among prospective retained Sailors prior to the retention decision point. Sailors, unfortunately, would not have an incentive to truthfully reveal their NMI values prior to the retention decision point if they knew the NMI package information they provided would determine the package of NMIs that all Sailors would receive for free.

4. Including NMI Based on Sailor Feedback

a. Value More or Less than Cost

A possible approach to the problem of identifying appropriate incentives to include in the UIP would be to publish the cost of the incentives and ask Sailors if they value said incentive as much or more than that cost. The problem with this approach is that respondents may inflate their values to ensure that an incentive will be offered.

b. Relevant Population

Furthermore, only the valuations among *retained* Sailors are appropriate for determining what incentives should be included in the universal package. The set of retained Sailors is the population that will determine if the NMI total value exceeds

its total cost. Sailors not retained may have high values for some NMIs, but their values will not be realized if they are not retained. Therefore, it would be difficult to know which Sailors to include in any poll of NMI values.

c. Determining Usage Rate

The question still remains: At what level of Sailor value should NMIs be included in the package? As discussed, this answer depends on the value distribution of the retained Sailors, as well as how many retained Sailors actually use the incentives. More extensive surveys are required to draw conclusions about the value distributions of Navy Sailors. All of the value distributions from the both the SWO and Enlisted Retention Surveys, however, were heavily concentrated to the left (low values)—with a large cluster of values at zero, but with a long tail to the right (high values). The enlisted Sailor sabbatical example in Figure 20 has 59% of its values at zero, a skewness of 2.79, but a maximum value of \$65,000. The median value is zero dollars, and the mean is \$4,706.

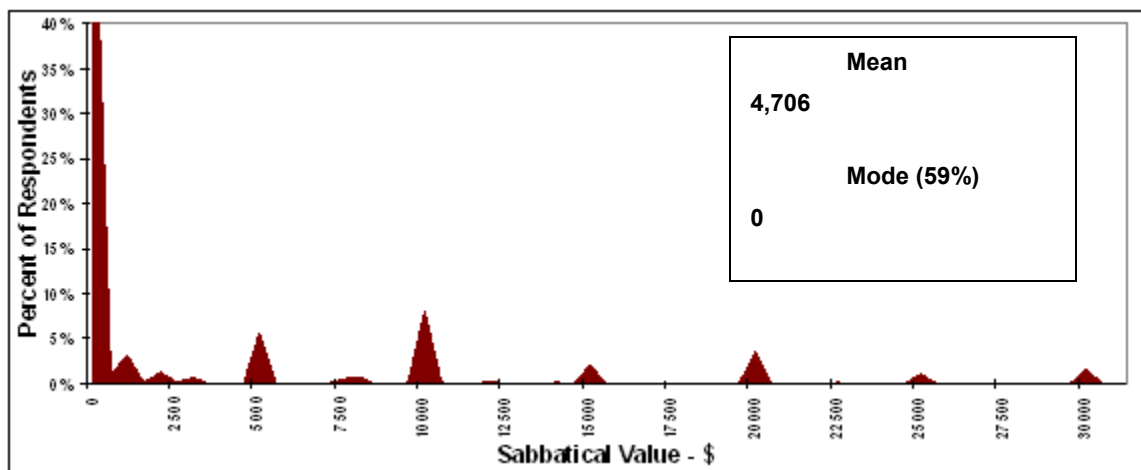


Figure 20. Value Distribution for One-year Sabbatical

For this sample, if it costs \$4,370 to provide a one-year sabbatical to an enlisted Sailor, only 27.2% of the Sailors value the incentive more than its cost. If the Navy retained 100% of the enlisted Sailors surveyed and if all received and used the Sabbatical NMI, the total NMI value (V_{NMI}) would approximately equal the total NMI cost (C_{NMI}). This is essentially the break-even point because the NMI cost equals the mean value. For the sake of illustration, we assume all Sailors are

retained and use the NMI. In contrast, if the NMI cost is just \$70 less (\$4,300), $V_{\text{NMI}} - C_{\text{NMI}}$ would show a gain of \$42,185. This is true even though the same percentage of individuals values it more than it costs. If the cost is \$70 more (\$4,440), the total $V_{\text{NMI}} - C_{\text{NMI}}$ would be a *negative* \$42,234.

The 75th percentile value for this value distribution is \$5,000. If Sabbaticals cost the Navy \$5000 with this sample, the Navy would save \$1,615,085 in retention costs if it offered this NMI and reduced the monetary SRB for all retained Sailors by their stated willingness to pay for this NMI. This assumes only Sailors who placed a positive value on Sabbaticals actually used it. This is probably not realistic: Sailors may not be willing to forgo some of their bonus to receive a benefit, but they may use it if it is offered for free. For example, a single Sailor may not place a value on his commissary benefits, but he may occasionally use the facility. Alternatively, the Navy would *lose* \$379,914 by offering the one-year Sabbatical option under the \$5,000 cost scenario if all 603 enlisted Sailors in the sample used it. This clearly illustrates how crucial offerings determination is with the Universal package.

5. Potential Benefits and Limitations

For the Universal Incentive Package to be cost-effective, it should include only those incentives for which the total Sailor Value exceeds the total cost to provide. In the optimally designed UIP, NMIs a and b in Figure 21 would be included; NMIs c and d would not. This package design has the potential to save the Navy money. This assumes that Sailor values and likelihood of use can be accurately predicted. Unfortunately, discovering these values and probabilities can be problematic, and the results could be disastrous. The above example showed the net result of offering enlisted Sabbaticals ranges from a savings of \$1.6 million to a cost of approximately \$379,000; cost effectiveness depends on which Sailors actually use the benefit. Finally, the UIP is not Pareto optimal, i.e., there is still room to make some Sailors better off without hurting other Sailors. The potential Sailor benefits captured by offering incentives c and d in Figure 21 would not be realized with UIP.

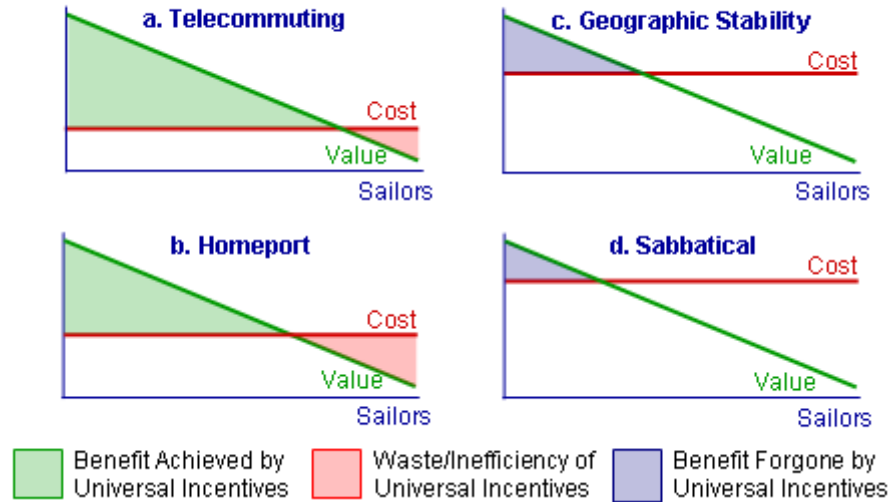


Figure 21. Limitations of a Universal Incentive Package
(After Coughlan et al., 2008)

D. Combinatorial Retention Auction Mechanism (CRAM)

1. Overview

The CRAM incorporates three elements that each serve a separate purpose:

1. Second-price Auction provides accuracy in setting bonus level;
2. A non-monetary incentive reduces the Navy's cost to retain a Sailor when that Sailor's value > cost for that NMI;
3. Combinatorial auctions provide individualized incentive packages with no "wasted" incentives.

Under the CRAM, a retained Sailor receives a particular NMI only if he expresses a willingness to pay for the incentive that exceeds the Navy's cost to provide the incentive. This eliminates the need to determine which incentives to offer; all incentives are offered to all Sailors and are allocated to those whose value exceeds cost. For those non-monetary incentives whose cost varies significantly depending on the number of participants, there are a number of variations of the CRAM which can be adopted to accommodate varying (presumably increasing) unit costs. This includes using equilibrium prices (for which the supply or marginal cost

curve intersects the demand or value curve), average costs or quantity limits (quotas) for each NMI (these options will not be discussed in detail here).

2. Process Description

The CRAM Auction is very similar to the auctions used for monetary retention and the Universal Incentive Package described above. Each Sailor bids the minimum SRB he would require if the retention incentive was cash-only. Each Sailor also indicates how much his cash bonus could be reduced for each non-monetary incentive, if that non-monetary incentive were included in his retention package.

After receiving these bids, the auctioneer calculates the minimum cost package required to retain each Sailor. Each minimum cost package includes any NMI for which the Sailor's value exceeds the Navy's cost. To calculate the Sailor's provisional cash bonus, the Sailor's required cash-only bonus is reduced by the NMI value stated in the initial bid for any NMI offered that Sailor. The Navy's total cost of those incentives is then added to the provisional cash bonus to derive the Sailor's "effective" cost to the Navy—or the Navy's total cost of the package bid.

After calculating each Sailor's minimum cost-retention package, lowest-cost Sailors are retained. Each retained Sailor receives his/her individualized NMI package plus a cash bonus that equals the Navy's effective cost for the first excluded bid minus the Navy's cost of his incentive package. Note that the Navy's total retention cost is the same for every retained Sailor. Each Sailor receives a personalized NMI package and values the incentives differently, so the value of the retention incentive varies across Sailors. The value each Sailor receives from his/her retention package equals or exceeds the Navy's retention cost; in many cases, a Sailor's value significantly exceeds the Navy's cost (Coughlan et al., 2008). Furthermore, the value for each retained Sailor's retention package exceeds his/her cash-only bonus requirement.

3. Process Example

The graph in Figure 22 continues the example from section B.3 above. In this example, three Sailors truthfully bid their minimum required cash-only SRB (given

that this is a generalized, second-price auction), and each states the dollar amount of that bonus he would sacrifice for each of the two available NMIs; each NMI is assumed to cost the Navy \$20,000 per Sailor. Each Sailor's minimum-cost bid package includes any NMI for which his value exceeds cost. Given the values shown in Figure 22, Sailor 1's bid package would include incentive 1; Sailor 2's bid package would include incentive 2; and Sailor 3's bid package would include both incentives. The auctioneer then calculates a revised minimum cash retention bonus. This is the original cash bonus bid minus the sum of the stated values for each NMI included in the bid package. Each Sailor's minimum cost to retain is then this revised minimum cash bonus plus the total cost of any NMIs included in the bid package.

Sailor #	Min. \$ to Retain	Incentive 1 Value	Incentive 2 Value	Total Incentive Cost	Total Incentive Value	Revised Min. \$ to Retain	Total Cost to Retain	Cash Bonus	Total Value Received
1	\$80K	\$40K	\$10K	\$20K	\$40K	\$40K	\$60K	\$60K	\$100K
2	\$90K	\$10K	\$30K	\$20K	\$30K	\$60K	\$80K	-	-
3	\$100K	\$30K	\$40K	\$40K	\$70K	\$30K	\$70K	\$40K	\$110K

Figure 22. Enlisted Retention Example: CRAM
(After Coughlan et al., 2008)

As shown, if the Navy plans to retain two of these three Sailors, Sailors 1 and 3 would be retained, as they have the two lowest retention costs. Each of the retained Sailors would receive the NMIs included in their bid package; each also would receive a cash bonus equal to the total —effective” cost of the first excluded bid (\$80,000 in the example) minus the Navy's total cost of the NMIs included in that package.

4. The Advantage of CRAM

The example in Figure 22 illustrates the money-saving potential of the CRAM Auction. Under a second-price retention auction with monetary incentives alone, Sailors 1 and 2 would be retained for a cash bonus equal to the first excluded cash bid; the \$100,000 bid submitted by Sailor 3. Thus, the total cost to retain two Sailors under a cash bonus is \$200,000. Under the CRAM, Sailors 1 and 3 would each be

retained at a cost equal to the total cost of the first excluded package bid. This cost is the Navy's \$80,000 effective cost associated with Sailor 2's minimum cost package bid. Thus, the total cost to retain two Sailors under CRAM is \$160,000.

Compared to the purely cash retention auction, CRAM retains the same number of Sailors but reduces the total cost to the Navy. In addition, CRAM potentially increases the Sailors' surplus. The mechanism substitutes cash SRB payments with individualized NMI packages when individuals state a willingness to pay that is no less than the Navy's cost, but the Sailors' cash bonus is only reduced by the Navy's NMI cost. As a result, each Sailor's surplus equals or exceeds their surplus under the cash only auction, but at a lower cost to the Navy: a true win-win situation.

Compared to the Universal Incentive Package, CRAM increases efficiency by enabling the Navy to capture the surplus represented by the green triangles in Figure 23, and by eliminating the Navy's potential waste associated with the red triangles under the UIP. CRAM further increases efficiency by capturing the surplus from incentives not offered under the UIP, as represented by the blue triangles in Figure 23.

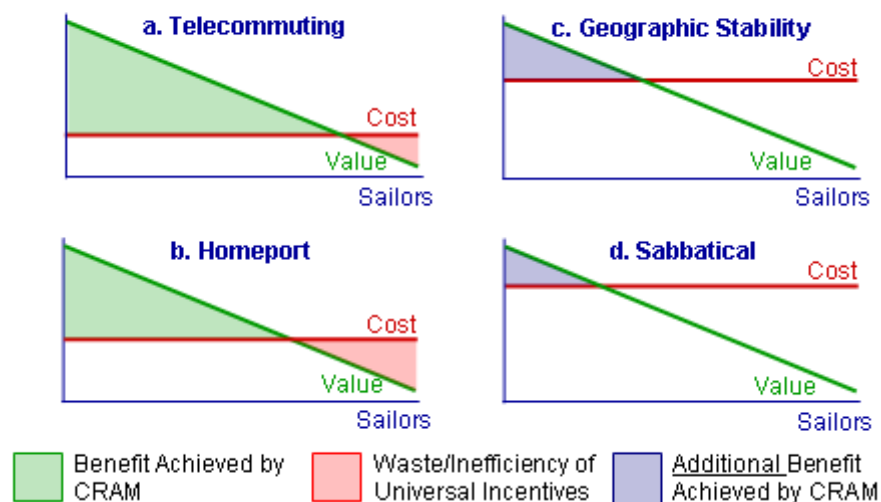


Figure 23. CRAM Overcomes the Universal Package Weakness
(After Coughlan et al., 2008)

Further, CRAM eliminates the difficulties involved in identifying the optimal universal incentive package: truthful revelation of the NMI values, identifying the relevant (retained) population of Sailors, and predicting the actual NMI usage rate. Finally, CRAM potentially changes the “mix” of Sailors retained. In the example above, Sailors 1 and 2 were retained under a strictly monetary retention auction; Sailors 1 and 3 were retained under CRAM. The potential impact of CRAM on population diversity is discussed further in Chapter VII.

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VI. Simulation Design and Results

A. Design

1. General

Simulations of the various retention mechanism alternatives were conducted using the data from the SWO and Enlisted Retention Survey. In particular, three separate generalized, reverse, second-price auction mechanisms were simulated: Monetary, UIP, and CRAM.

The UIP and CRAM simulations require estimating the marginal (or average) cost of each NMI. In the absence of specific cost estimates for the various NMIs, it is reasonable to base costs projections on the value distributions from the surveys. In particular, we assume that the cost of each NMI falls between some lower bound cost and the respondents' maximum submitted valuation (between \$25,000 and \$100,000, depending on the survey and NMI). Thus, it is reasonable to simulate each NMI cost as falling within some range of the submitted valuation for that NMI.

In each simulation trial, a random number (x%) was drawn for each NMI from a uniform distribution between 0% and 100%. The NMI cost was then simulated as the lower bound cost plus x% of the range between the lower bound cost and the maximum submitted value. For example, if the relevant cost range was between \$5,000 and \$25,000, a \$20,000 range, and random percentage drawn was 25%, the simulated cost would equal \$10,000; $\$5000 + (0.25 * \$20,000)$.

To provide the broadest generality of results, two cost assignment methods were used: Varying Percentile Cost – All Positive (VP(AP)) and Varying Percentile Cost – High Positive (VP(HP)). In the VP(AP) model, the lower bound for the cost of each NMI was the first positive value from the respondents' answers. Thus, the cost of each NMI was drawn from the range of positive submitted values for that NMI. For a more conservative (higher) cost estimate, the VP(HP) model set the lower cost bound at the median of the VP(AP) cost range, or halfway between the first positive and maximum values. Both costing schemes assumed constant marginal costs.

Additionally, the NMI values were assumed to be additive for Sailors who received more than one incentive—unless another value was given by the respondent. Similarly, costs were assumed to be additive for multiple NMIs.

Finally, each Mechanism was simulated at the 25%, 50%, and 75% retention levels (see Table 8). For perspective, the Navy's current overall Zone A, B, and C reenlistment rate goals are 48%, 58%, and 82%, respectively (Chief of Naval Operations, 2007, December).

Table 8. Simulation Varieties

Parameter	Values Simulated
Retention Mechanism	<ol style="list-style-type: none"> 1. Monetary incentives alone 2. Universal Incentive Package (UIP) 75% cutoff for NMI inclusion in package 3. Combinatorial Retention Auction Mechanism (CRAM)
Retention Levels	<ol style="list-style-type: none"> 1. 25% of population retained 2. 50% of population retained 3. 75% of population retained
Cost Assumptions	<ol style="list-style-type: none"> 1. Varying Percentile (All Positive) NMI costs vary over entire non-zero range of bidder values 2. Varying Percentile (High Positive) NMI costs vary over upper-half of non-zero bidder values

2. Monetary Only Simulation

To simulate the monetary-only auction, the survey responses were used to determine each Sailor's required cash SRB. The Sailors were then ranked from most to least expensive. The lowest set of n Sailors was retained, and each paid the cash bonus of the first excluded bid (i.e., the $n+1$ st lowest bid). The number of Sailors retained (n) varied according to the retention levels in Table 4.

3. UIP Simulation

Simulating the UIP requires determining when to include an NMI in the Universal Package. To be the most "generous" to UIP and conservative with respect to CRAM's relative performance, we chose a cost cutoff to include an NMI in the UIP that was close to optimal for UIP, although this optimal cutoff would be impossible to determine in actual practice. The optimal cost cutoff for each NMI was

calculated by determining the cost for which the total Sailor surplus (value minus cost summed over all Sailors with value greater than cost) equaled the total deficit (cost minus value summed over all Sailors with value less than cost). This is the breakeven cost for an NMI to be included in the UIP; the Navy would realize a negative surplus if the UIP included NMIs with costs higher than this breakeven value; the Navy would realize a positive surplus if the UIP included NMIs with costs lower than this breakeven value.

Figure 24 illustrates the optimal UIP cutoff percentile for each NMI in the SWO survey; Figure 25 provides the UIP cutoffs for the Enlisted Sailor Survey. This is based on the sample's NMI value distribution. It is important to note that these cutoffs are only truly optimal if the retained Sailors' value distribution matches the overall Sailors' value distribution. If the retained Sailors actually value the NMIs more than the overall population, the optimal percentile would be higher. Conversely, if the retained Sailors actually value the NMIs less than the overall population, the optimal percentile would be lower.

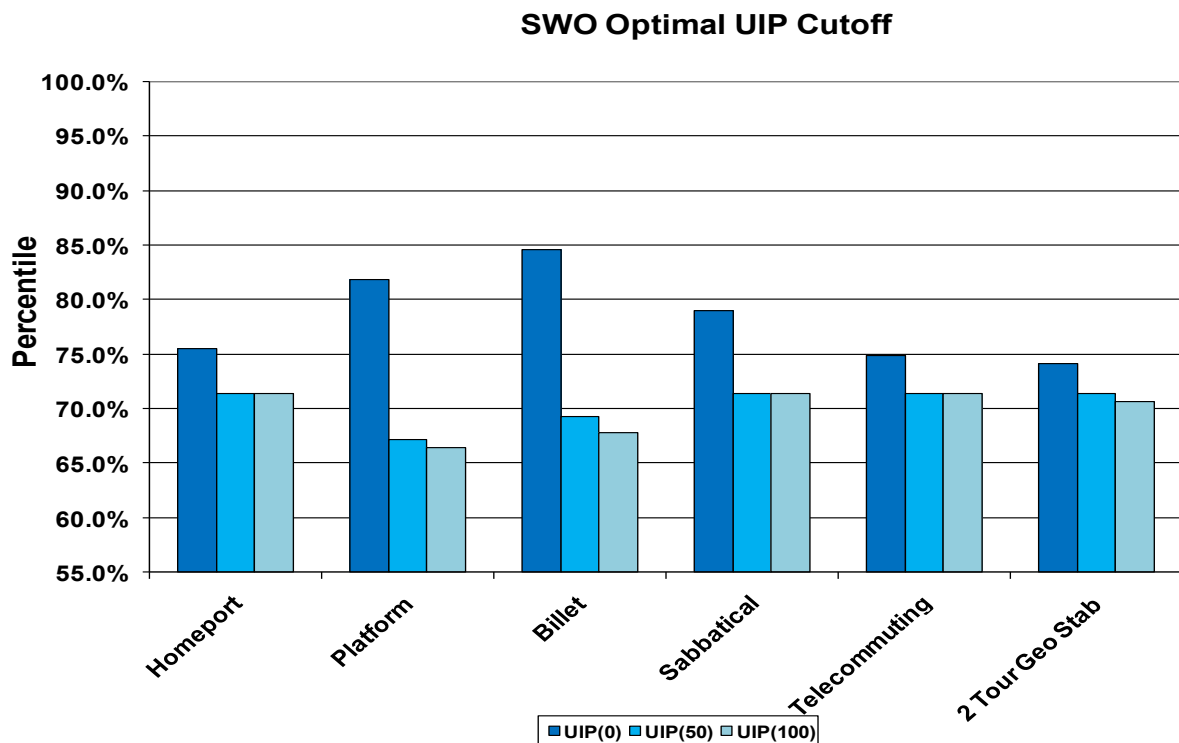


Figure 24. Optimal UIP Cutoff Percentile—Enlisted Sailor Survey

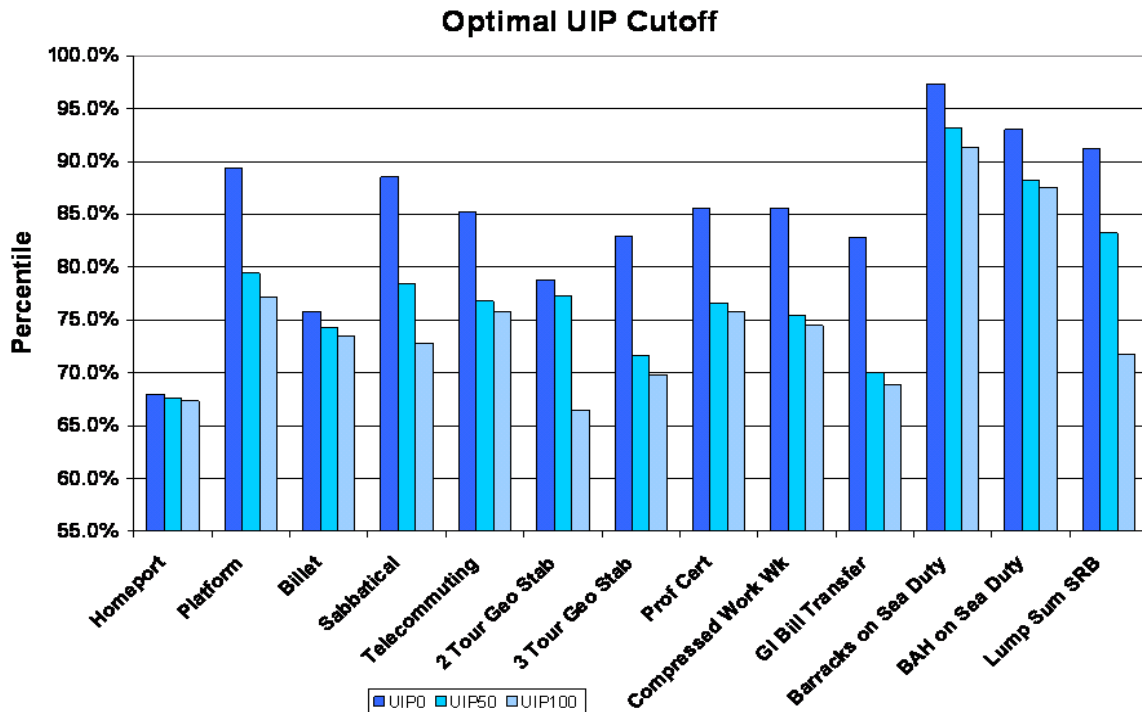


Figure 25. Optimal UIP Cutoff Percentile—Enlisted Sailor Survey

Under the UIP mechanism, any NMI that the Navy offers is available to any retained Sailor. All Sailors expressing a positive value for this incentive will clearly choose to use the incentive. Some Sailors that do not express a willingness to pay for the NMI may still take advantage of the opportunity given that the incentive is offered at no charge. Thus, a Sailor might have responded in the survey that receiving a particular NMI would not reduce his minimum required SRB; the same Sailor might, nonetheless, use that NMI if it were offered free of charge. Determining the total cost of retaining Sailors under UIP requires assumptions about NMI usage. Three assumptions were compared:

1. UIP(0)—Only those Sailors who placed a positive value on the NMI will actually use it;
2. UIP(50)—50% of those who place no value on the NMI will also use it;
3. UIP(100)—Everyone retained will use the NMI.

Because the actual usage rate would be somewhere between UIP(0) and UIP(100), the average optimal cutoff would be approximately the 75th percentile, as is shown in Tables 9 and 10.

Table 9. SWO Optimal UIP Cutoff Percentiles

	Homeport	platform	billet	One Year Sabbatical	Telecommute	2 Tour Geo Stability
UIP(0)	75.5%	81.8%	84.6%	79.0%	74.8%	74.1%
UIP(50)	71.3%	67.1%	69.2%	71.3%	71.3%	71.3%
UIP(100)	71.3%	66.4%	67.8%	71.3%	71.3%	70.6%

Table 10. Enlisted Optimal UIP Cutoff Percentiles

	Homeport	platform	billet	One Year Sabbatical	Telecom	2 Tour Geo-Stability	3 Tour Geo Stability	Professional Certification	Compressed Work Week	GI Bill Transfer	Barracks on Sea Duty	BAH on Sea Duty	Lump Sum SRB
UIP(0)	68.0%	89.4%	75.8%	88.6%	85.2%	78.8%	82.9%	85.6%	85.6%	82.8%	97.3%	93.0%	91.2%
UIP(50)	67.7%	79.4%	74.3%	78.4%	76.8%	77.3%	71.6%	76.6%	75.5%	70.0%	93.2%	88.2%	83.3%
UIP(100)	67.3%	77.1%	73.5%	72.8%	75.8%	66.5%	69.8%	75.8%	74.5%	68.8%	91.4%	87.6%	71.8%

The 75th percentile cost cutoff was used as the general rule in these simulations because it was consistent with the data regarding the optimal cutoff and because it was a simple, functional cutoff rule (and thus would be easier to use than a different cutoff rule for each NMI or some precise cutoff rule, such as 77.9%). Additionally, the UIP included only those NMIs that at least 25% of the Sailors valued more than their cost to provide (under the 75th percentile cutoff rule). This included most of the NMIs, but not those whose costs would exceed more than 75% of the Sailor values.

Note that the enlisted simulations using the VP(AP) costing scheme never offered more than a couple of NMIs in the UIP (e.g., barracks room on sea duty and BAH on sea duty for enlisted Sailors) because their first positive values occurred at the 88th and 84th percentiles, respectively. Under the VP(HP) costing scheme, only three NMIs were offered in the enlisted UIP. The other 10 NMIs' costs always exceeded the cutoff percentile. This determination worked to the advantage of the

UIP by preventing many situations in which NMI cost would exceed total Sailor value. The SWO simulations were not as restrictive.

To simulate the Universal Incentive Package, the initial SRB requirement (SRB_i) was derived the same way as in the monetary auction: from the SRB cash values the Sailors provided in the survey. The stated NMI values were used to determine the value each Sailor placed on each incentive. If an incentive was included in the UIP, the Sailor's SRB_i was reduced by the value stated for that NMI ($Value_{NMI}$) to generate a "provisional" SRB bid for that Sailor. This simulated the process by which Sailors would bid in a second-price auction given a fixed package of incentives. Note that the Navy would not observe the Sailors' willingness to pay (WTP) for the non-monetary incentives under a UIP retention program; the Navy would only observe their adjusted SRB bid. The Sailors were then ranked on their new provisional SRB bids. Each retained Sailor received a monetary SRB equal to the first excluded provisional bid. Retained Sailors were all eligible for the same cash bonus and a standardized NMI package, but each Sailor has individualized preferences—creating a unique "value" for the NMIs offered.

4. CRAM Simulation

The CRAM simulations used the same initial SRB (SRB_i), NMI value ($Value_{NMI}$) and NMI cost ($Cost_{NMI}$) determinations as above. However, all NMIs were offered to all Sailors in this model; Sailors were only offered those SRBs for which the value exceeded the simulated cost (i.e., Sailor surplus was positive). With this mechanism, the Navy observes both the Sailor's SRB bid and the value derived from each NMI. The Sailors' provisional SRB (SRB_P) was set equal to SRB_i minus the value associated with each NMI allocated. However, to mimic a generalized combinatorial second-price auction and ensure truthful revelation, Sailors were retained based on effective cost ($Cost_E$) to the Navy, using the following formula:

$$Cost_E = SRB_P + \sum Cost_{NMI}$$

where the $Cost_{NMI}$ amounts were summed only over those NMIs allocated to that Sailor (i.e., those for which value exceeded cost).

Sailors were ranked from lowest to highest effective cost, and the least expensive set was retained. The Navy's total cost of each individual retention package ($Cost_T$) was equal to the $Cost_E$ of the first excluded bidder:

$$Cost_T = SRB_I - \sum Value_{NMI} + \sum Cost_{NMI}.$$

The cash award for each individual Sailor was determined by subtracting the cost of each allocated NMI from the Navy's total cost of the retention package ($Cost_T$). Thus, each retained Sailor had the same cost to the Navy ($Cost_T = Cost_E$ of the first excluded bidder). However, each Sailor's cash award depended on the NMIs in the individualized package and their individual costs.

Each Sailor received a value equal to their cash SRB plus their value for the NMIs in their individualized incentive package. Values varied across Sailors, depending on the number of NMIs allocated and each Sailor's value. Nonetheless, in all cases, the value received by each retained Sailor equaled or exceeded the cost to the Navy of providing the retention incentive package.

5. Simulation Runs

For each retention level described in Table 8, 1,000 trials were simulated to obtain an adequate range of outcomes. Both UIP and CRAM results were compared to the monetary auction. It is important to note that these comparisons assume costs that were allowed to range over the positive portion of value distributions, with upper bounds commonly as large as \$50,000 or more. If true NMI costs are, in fact, in the lower range of the value distribution, the savings over monetary incentives may be significantly understated; if true costs are in the upper range of the value distribution, the savings over monetary incentives may be significantly overstated.

B. Results

Recall the two cost assignment methods used: Varying Percentile Cost, All Positive (VP(AP)), and Varying Percentile Cost, (High Positive (VP(HP))). In the VP(AP) method, the lower bound for each NMI was based on the percentile that

included the first positive value from the respondents' answers. The VP(HP) method set the lower bound halfway between the first positive percentile and 100, or the median of the VP(AP). Tables 11 and 12 detail the lower-bound, mean, median, and maximum dollar amount for the entire VP(AP), from the SWO and enlisted surveys, respectively. They also detail the lower bound and median for the VP(HP). The VP(AP) mean costs in column 4 provide plausible cost estimates; however, to be conservative, the upper half of the VP(AP) range was also sampled to simulate the possibility of higher actual costs.

It is clear from the figure that the VP(AP) lower-bound cost estimates are probably too low, as they range from \$1 to \$13. What is not clear is where the estimated costs become reasonable. For example, to provide a Second Class Petty Officer (with two dependents) with a one-year Sabbatical would cost at least \$6,785 (within the VP(AP) lower half)—the estimated cost to provide medical, dental, vision, and commissary benefits to that Sailor. Additional costs of administering the program, retraining and potential lost productivity would add to that cost (possibly above the VP(HP) lower bound). Appendices D and E contain the detailed results from the VP(AP) method, and Appendices F and G contain the detailed results from the VP(HP) method.

Table 11. SWO Varying Cost Percentiles for NMI Cost Estimates

	VP(AP) Lower bound		VP(HP) Lower Bound VP(AP) Median		VP(AP) Mean	VP(HP) Median		Maximum
	Percentile	Cost	Percentile	Cost		Percentile	Cost	
Homeport	34	\$100	67	\$10,000	\$10,694	84	\$25,000	\$75,000
Platform	53	\$1	77	\$5,000	\$3,672	88	\$10,000	\$50,000
Billet	41	\$1	71	\$10,000	\$7,229	85	\$15,000	\$70,000
One Year Sabbatical	51	\$1	76	\$20,000	\$11,060	88	\$25,000	\$100,000
Telecommuting	43	\$1	71	\$11,434	\$11,249	86	\$25,000	\$75,000
Geographic Stability (2 tours)	36	\$1	68	\$10,000	\$11,707	84	\$25,000	\$75,000

Table 12. Enlisted Varying Cost Percentiles for NMI Cost Estimates

	VP(AP) Lower bound		VP(HP) Lower Bound		VP(AP) Mean	VP(HP) Median		Maximum
	Percentile	Cost	Percentile	Cost		Percentile	Cost	
Homeport	35	\$1	67.5	\$10,000	\$9,749	83.75	\$10,000	\$50,000
Platform	64	\$1	82	\$5,000	\$7,066	91	\$10,000	\$50,000
Billet	40	\$1	70	\$5,000	\$8,917	85	\$10,000	\$51,502
One Year Sabbatical	63.5	\$1	81.75	\$10,000	\$12,917	90.875	\$20,000	\$65,000
Telecommuting	50	\$13	75	\$7,750	\$11,661	87.5	\$15,000	\$70,000
Geographic Stability (2 tours)	51	\$7	75.5	\$5,539	\$9,385	87.75	\$10,000	\$50,000
Geographic Stability (3 tours)	47	\$1	73.5	\$10,000	\$12,460	86.75	\$15,000	\$80,000
Professional Certification	62	\$1	81	\$5,000	\$9,524	90.5	\$10,000	\$60,000
Compressed Work Week	60	\$1	80	\$5,000	\$8,157	90	\$10,000	\$41,026
Transferability of GI Bill	45.5	\$1	72.75	\$10,000	\$12,405	86.375	\$20,000	\$75,000
Single Barracks Room on sea duty	88.5	\$1	94.25	\$3,000	\$5,446	97.125	\$5,650	\$25,000
BAH on sea duty	84	\$1	92	\$5,400	\$8,923	96	\$10,000	\$50,000
Lump Sum SRB	58	\$3	79	\$5,000	\$10,427	89.5	\$10,000	\$90,000
* excludes outliers								

1. Varying Percentile (AP) Cost Results

As shown in Figures 26 and 27 for the SWO and enlisted surveys, respectively, the largest total dollar savings occurred at the highest retention level. The total CRAM savings increases as the Navy retains more Sailors. For the SWO community, the CRAM dollar savings over purely monetary retention bonuses range from \$914,000 to \$7,929,000 as retention rates increase from 25% to 75%; CRAM dollar savings over purely monetary retention bonuses range from \$3,640,000 to \$11,254,000 as retention rates increase from 25% to 75% in the enlisted community.

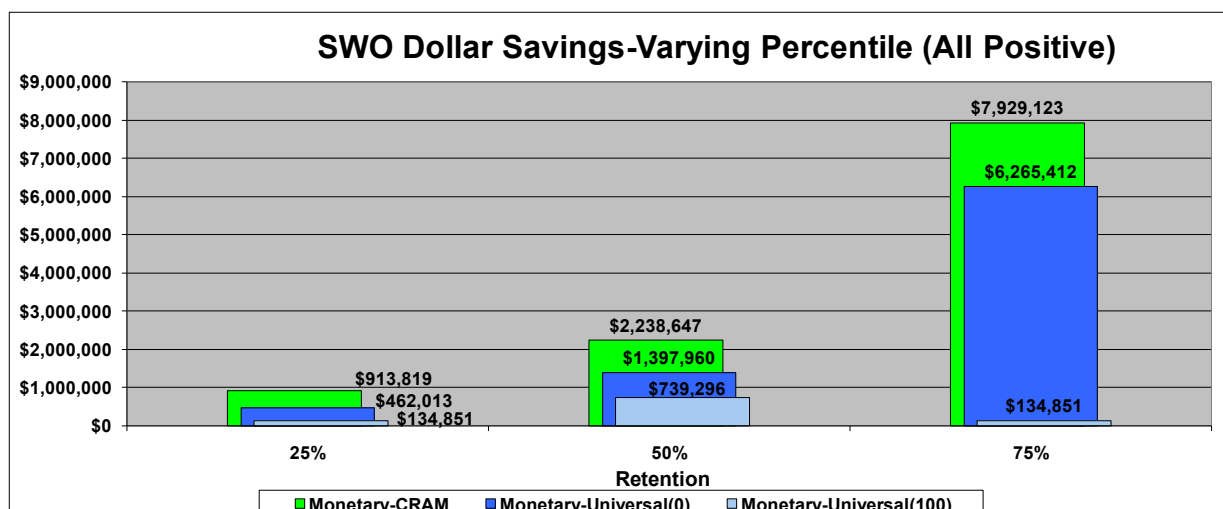


Figure 26. SWO Average Dollar Savings—VP(AP)

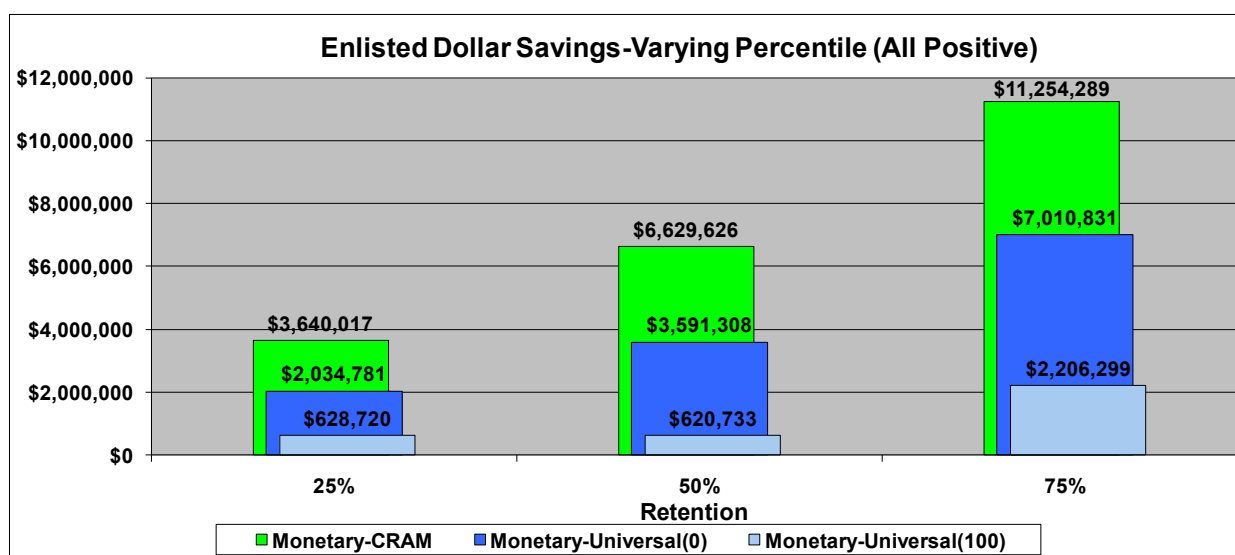


Figure 27. Enlisted Average Dollar Savings—VP(AP)

While the total CRAM savings are higher at higher retention rates, so are total retention costs. Percent cost savings are more complicated. With purely monetary retention incentives, the Navy retains Sailors with low monetary incentive requirements at lower retention rates, while they are forced to retain Sailors with higher monetary incentive requirements at higher retention rates. The cost savings from CRAM and the UIP depend on the relationship between the monetary costs to retain and the value Sailors derive from NMIs. If there is a strong correlation

between monetary retention requirements and NMI values (i.e., Sailors requiring low monetary retention bonuses have low NMI values, and vice versa), the percent savings would likely increase as retention rates increase, yielding a higher percent savings at the higher retention levels. The percent cost savings from CRAM and UIP would be more apt to decrease as retention rates increase if there was not a direct relationship between monetary retention requirements and NMI values. Figures 28 and 29 show these results for the SWO and Enlisted surveys, respectively. For the VP(AP) SWO simulations, CRAM produced an average savings ranging from 28.3% to 42.3% over monetary; the Enlist CRAM savings ranged from 34.3% to 80.4%.

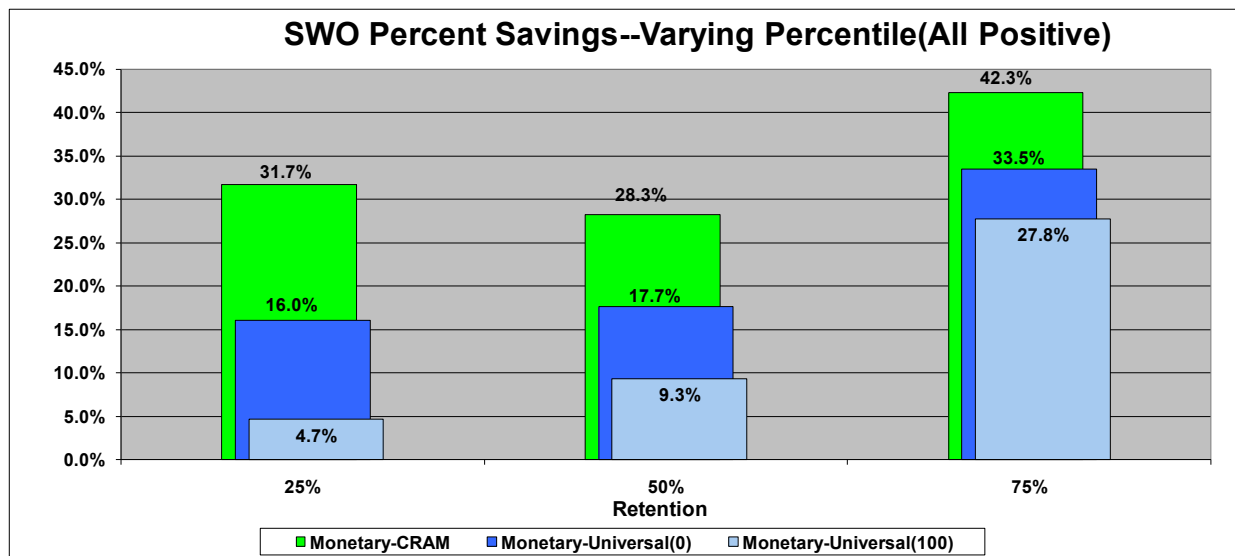


Figure 28. SWO Average Percent Savings—VP(AP)

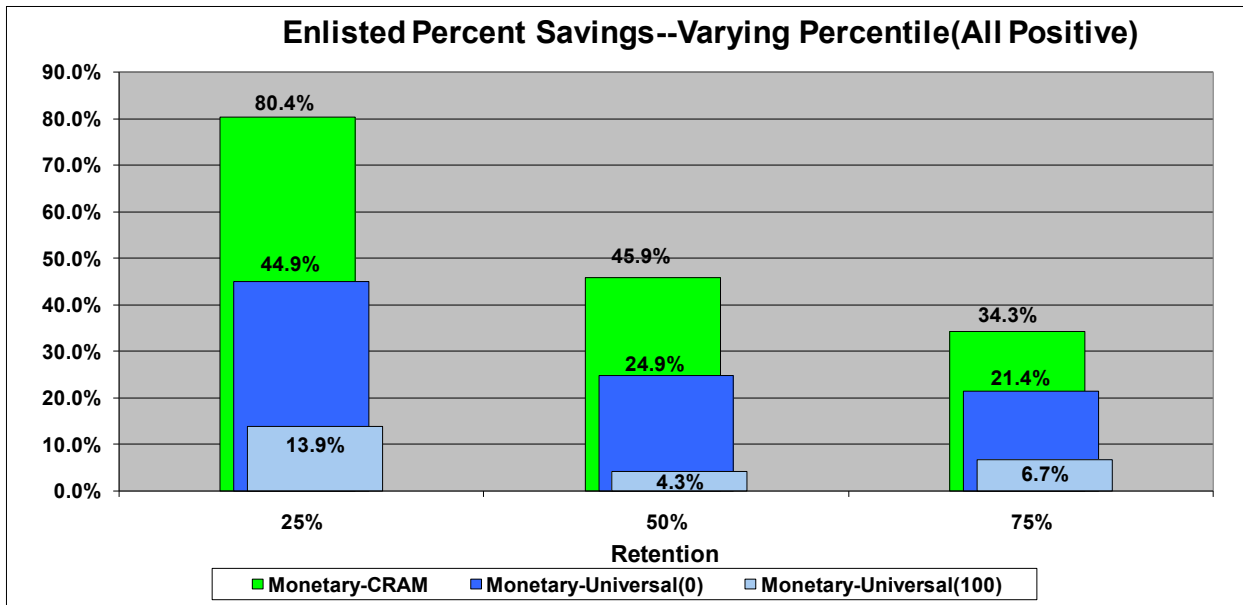


Figure 29. Enlisted Average Percent Savings—VP(AP)

2. Varying Percentile (HP) Cost Results

The Varying Percentile (HP) simulations measure the potential CRAM and UIP cost savings with higher NMI costs. As NMI costs increase, CRAM and UIP cost savings will decrease, but the effect is more significant for the UIP. Recall that the Universal Incentive Package can produce large benefits to the Navy when many Sailors value an incentive more than its cost. This is shown in Figure 30 by the green shaded areas in cases 30a and 30b. Because all Sailors who place any value on the incentive receive it (even if the Navy's cost exceeds that value), there is also a potential for a significant deficit associated with this incentive. This is shown by the red shaded areas in Figure 30 for cases 30a and 30b. As NMI costs increase, the potential surplus under UIP decreases (green shaded area) while the potential deficit increases (red shaded area). The potential deficit can be exacerbated if Sailors who express no value for an NMI choose to use it anyway when provided to all under UIP.

CRAM avoids these deficits by offering Sailors individualized NMI packages that only include NMIs for which that Sailor's value exceeds the Navy's cost. In addition, CRAM provides additional savings because it can offer NMIs excluded from the universal package. NMIs will be excluded from the UIP if they are valuable to

only a small group of Sailors. The Navy captures additional surplus value by including these NMIs in CRAM, as illustrated by the blue shaded areas in cases 30c and 30d in Figure 30. Under CRAM, the Navy can offer incentives that are highly valued by a small group of Sailors.

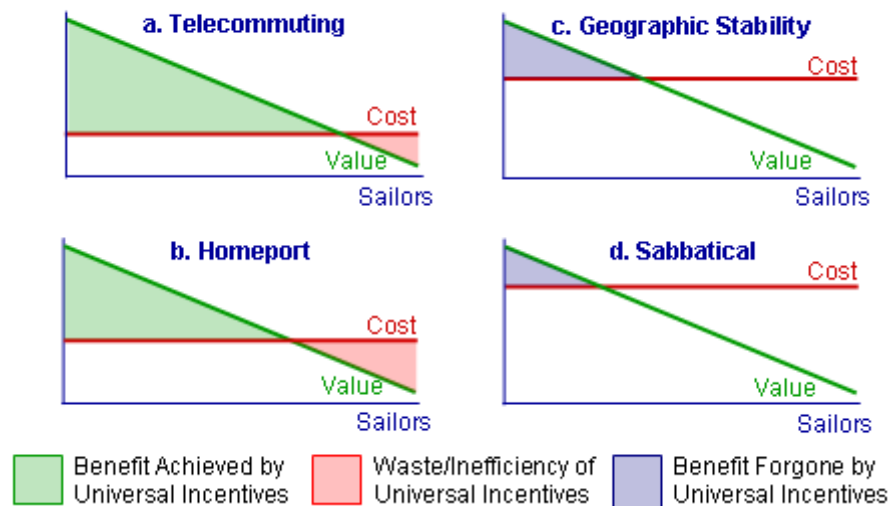


Figure 30. Limitations of a Universal Incentive Package
(After Coughlan et al., 2008)

In the simulations reported here, the Universal Incentive Package generally realized cost savings compared to the monetary auction under the UIP(0) assumption—assuming that NMIs are only used by Sailors who expressed a positive value. Under the UIP(100) assumption (all retained Sailors use the NMI), the result could show a significant Navy deficit, particularly with the higher NMI costs in the VP(HP) scenario. Dollar cost savings are provided in Figures 31 and 32 for the SWO and Enlisted surveys, respectively. Recall that these results assume a 75% NMI cost cutoff; the Navy only includes the NMIs that are the least likely to have total cost exceed total Sailor value, reflecting a —best case— UIP scenario (and the Navy can not identify the best case cost NMI cost cutoff in practice). Even with this —best case— advantage, the UIP often performed poorly.

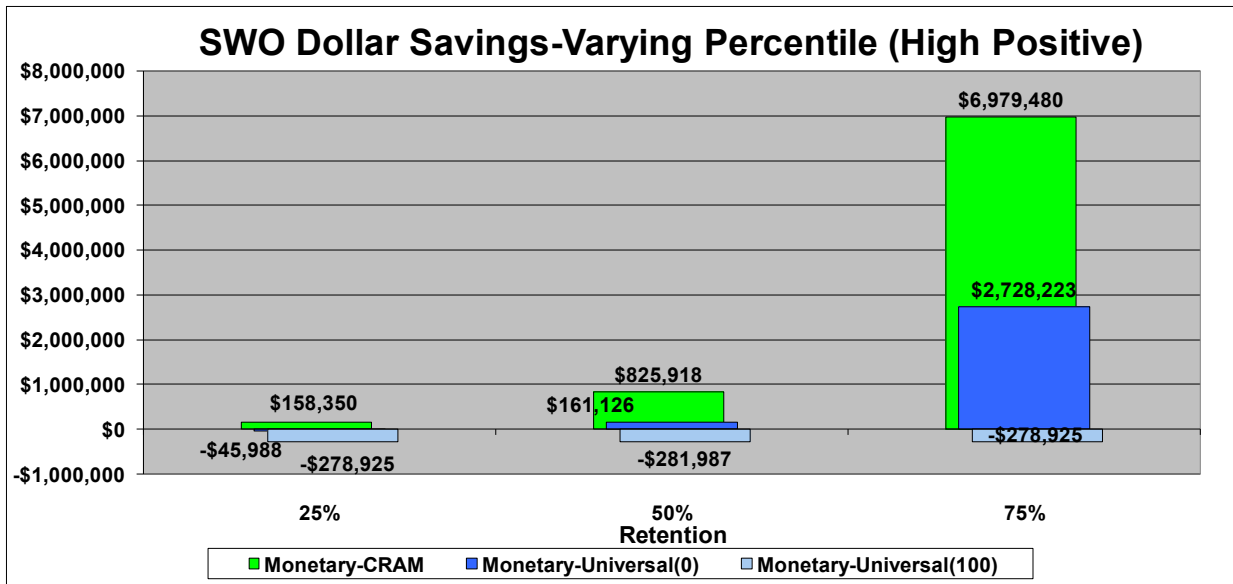


Figure 31. SWO Average Dollar Savings VP(HP)

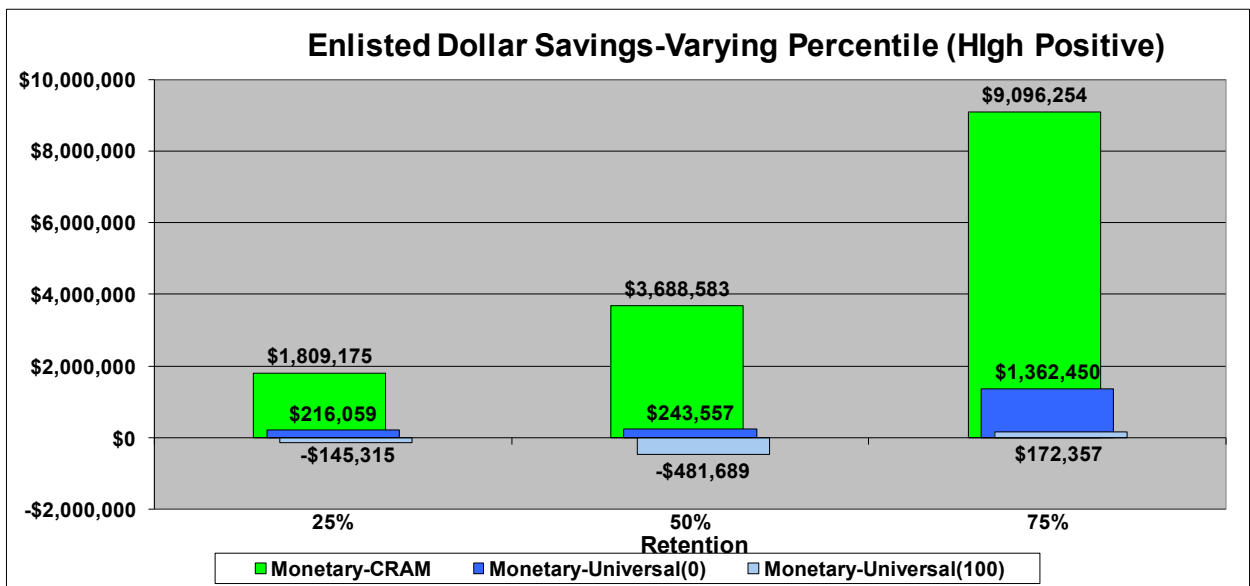


Figure 32. Enlisted Average Dollar Savings VP(HP)

The percent cost savings for CRAM and UIP are provided in Figures 33 and 34 for the SWO and enlisted surveys respectively. CRAM only allocates incentives to Sailors who value that incentive more than it costs. This makes it the most efficient method of distributing benefits. In every case, the CRAM Auction provided a significant percentage cost savings over the Monetary Auction (detailed results are

provided in Appendices D – G). CRAM provided a higher percentage cost savings than the UIP in all cases, as well.

The VP(HP) trials imposed a particularly stringent NMI cost cutoff for inclusion in the UIP, which worked to the advantage of UIP by not offering excessively “wasteful” NMIs. In the vast majority of cases, CRAM produced savings well above those of the UIP—especially when 50% or more of the UIP re-enlistees were assumed to use the non-monetary incentives, though they expressed no value (UIP(50)) and UIP(100)). In the VP(HP) simulations, CRAM savings vs. monetary averaged from 5.5% to 37.3% for the SWO survey and 25.5% to 39.9% for the Enlisted survey. UIP vs. monetary savings ranged from a deficit of 9.7% to a savings of 14.6% in the SWO survey; UIP vs. monetary savings ranged from a deficit of 3.3% (UIP(100)) to a savings of only 4.8% (UIP(0)) for the Enlisted survey.

CRAM is able to overcome the weakness of the UIP by capturing the entire potential Navy surplus and eliminating the waste (cases in which the Navy’s cost exceeds the Sailors’ value). CRAM also captures the surplus from incentives that would not be offered under the Universal Incentive Package.

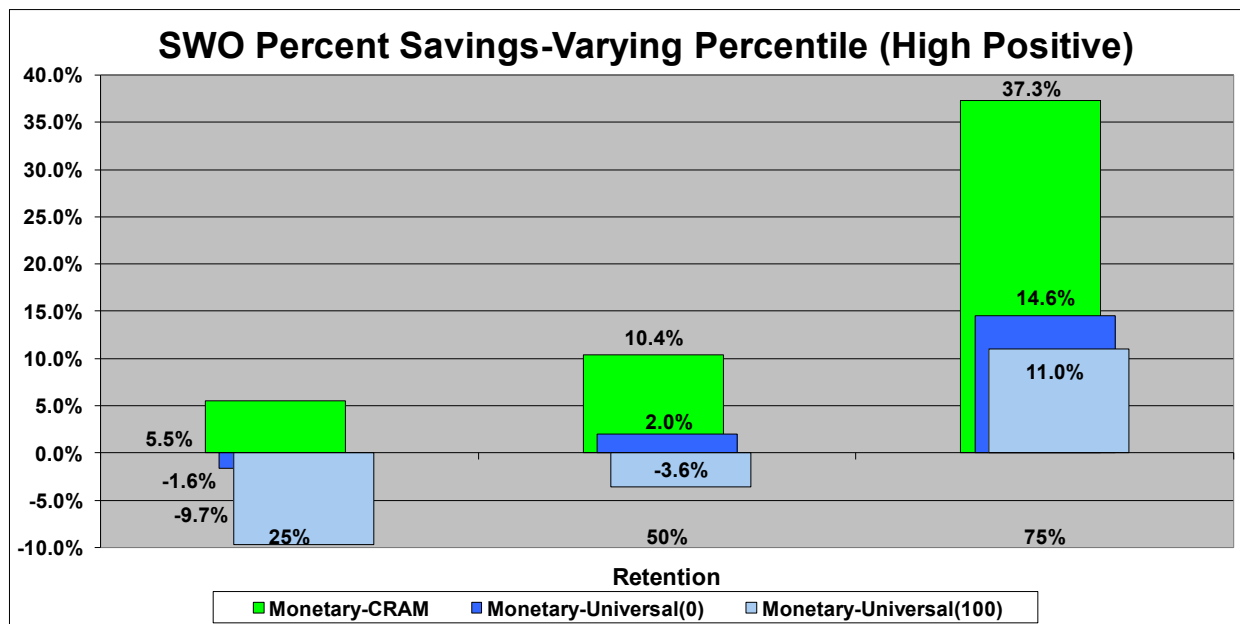


Figure 33. SWO Percent Savings VP(HP)

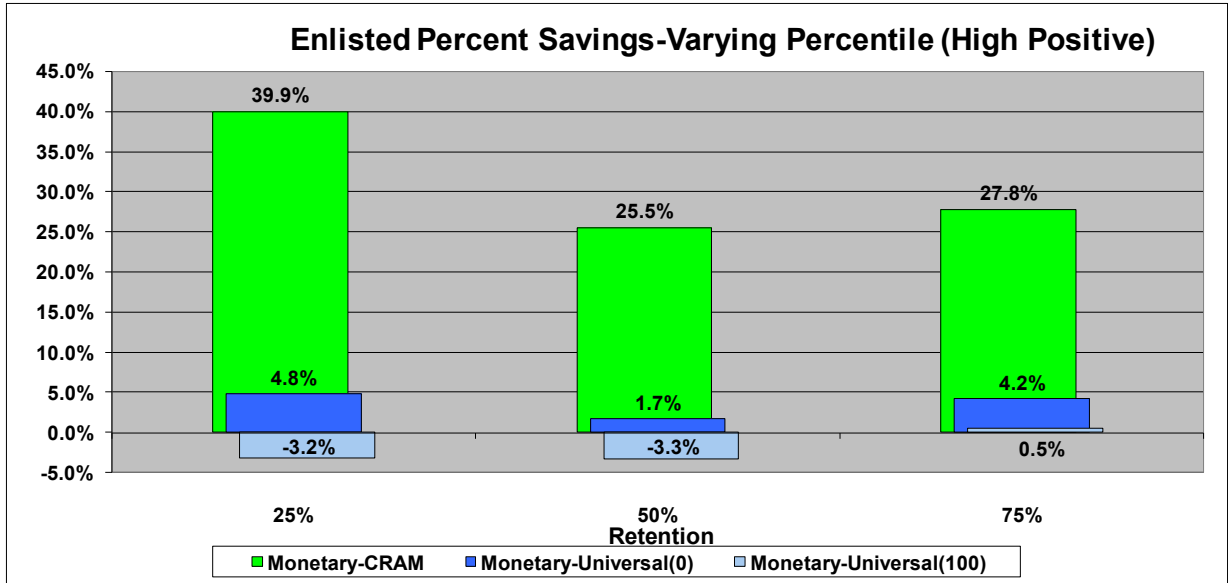


Figure 34. Enlisted Percent Savings VP(HP)

VII. Linking Preferences to Diversity

As leaders, we must anticipate and embrace the demographic changes of tomorrow, and build a Navy that always reflects our Country's make up. We must lead in ways that will continue to draw men and women to service to our Country and to our Navy. Diversity of thoughts, ideas, and competencies of our people, keeps our Navy strong, and empowers the protection of the very freedoms and opportunities we enjoy each and every day. (Roughead, 2008, February 28)

A. Motivation

Why is diversity important to the military? If achieved prudently and purposefully, it can enhance the political legitimacy, social equity, and the effectiveness of our military institutions. If applied arbitrarily, capriciously, or to achieve some notion of perfect representation, the resulting force will suffer on all three accounts.

This section will address each of the three core areas of concern—political legitimacy, social equity, and the effectiveness of the military with respect to population representation—to bear out each one's respective significance. It will then address representation in terms of new hires (known as —accessions” in the military) versus career force structure. Finally, it will discuss how, through reenlistment incentives, the military can achieve the optimal approximate representation desired/required by the society it is sworn to protect.

B. Statistical Representation Defined

Before discussing the three core areas of concern and how to address them, a brief discussion of statistical representation is necessary. It is important for the Nation's population to be statistically represented in the military. This does not mean —perfect representation.” Rather, it means representation within the acceptable range determined by society: acceptable approximate representation (Eitelberg, 2008). But what defines the range of acceptable deviations from perfect representation is highly dependent on the current attitudes and priorities of the country, as well as on the current statutes in effect. For example, prior to 1972,

there was a statutory ceiling on the percentage of women allowed in the military. It is no accident that the height of the women's rights movement coincided with the lift on that restriction.

The arguments that are made for moving toward or away from perfect statistical representation center around three areas:

Military effectiveness—meeting the need for personnel who are capable of performing military jobs; social equity—spreading the burden of national defense across all segments of the population; and political legitimacy—involving the belief that the military ought to be part of society rather separate from it (Eitelberg, 1977; as cited in CBO, 1989, p. 5).

Dr. Eitelberg discusses these three issues as —a ~~one~~ of concern around an age old question: Who shall serve when not all serve?" (Eitelberg, 2008).

Additionally, most often the military focuses on accessions and shifts policies to affect enlistment proportions while ignoring the reality that many of the —undesirable" representation issues are a function of who chooses to stay versus who chooses to join (CBO, 1989, p. 15). Perfect representation is not possible because, by its nature, the military is exclusionary: there are age limits, physical ability minimums, and fitness standards that are necessary to ensure minimum requirements for service (1989, p. 14). Even if the United States reinstated a random draft, it could not achieve perfect representation due to these limitations. What is more interesting is trying to determine where the right level of representation lies and how to achieve it.

C. Political Legitimacy

Throughout its history, the United States has had a significant distrust of a standing Army. This pattern can be traced back to the Revolutionary War, when the Continental Army was disbanded after the colonies gained independence. It has been borne out, time and again, following significant military campaigns. The framers of the Constitution were influenced by their experiences with the ubiquitous armies of Europe and their oppression of the people they were bound to protect. They recognized a need for a —common defense" but were leery of giving too much

power or substance to that same body (Segal & Segal, 2004, pp. 1-2). Another common theme in the Nation's history has been the quest to create a military that "looks like" American society. This is presumably to quell the fear of a standing army. If society shares a common ground with the military, it will either avoid conflicts of interest or a military subculture of "violent minded" individuals that would rise up against the people (CBO, 2007, p. 11). —Political legitimacy is most commonly associated with geographic representation because of presumed regional differences in attitudes toward the military (Eitelberg, 1979; as cited in CBO, 1989, p. 15)."

From a civilian point-of-view, those needs have formed the genesis for the quest for political legitimacy. For the military, political legitimacy is crucial to obtain funding, aid, and comfort from the Nation's citizens. Additionally, ensuring more geographical representation would be more likely to produce political leaders with military backgrounds and experience who would "grasp the complexities of defense policy [through their] first-hand experience with the military" (CBO, 1989, p. 2) Yet, in terms of enlisted accessions, the southern United States continues to be overrepresented and the northeast continues to be underrepresented. —The representation ratio (percentage of accessions divided by percentage of 18-24 year-olds from the region) for active accessions from the South was 1.2, compared to 0.7 for the Northeast, 0.9 for the North Central, and 1.0 for the West" (OSD(P&R), 2005a, p. vii). This unbalanced distribution may have a negative impact on both the civilian and military needs for political legitimacy.

D. Social Equity

In contrast, social equity has been a relatively recent concern with respect to military service. There are countless examples of inequality and discrimination in the Nation's history. Consequently, these inequities have characterized its military institutions. But the United States has evolved into a socially conscious society well on its way to achieving equal opportunity and social equity. Understandably, the military has paralleled, and often outpaced, the society of which it is a small but vital component.

The concern of social equity is centered on the issue of the —burden” of service (CBO, 1989, p. 8). The element of social equity becomes increasingly important to society in a time of war when burdens appear to outweigh benefits. The argument is that the physical dangers and personal sacrifice of military service are endured by the poor and minorities in higher proportion to their representation in society as a whole. This hypothesis is supported with historical anecdotes referencing military exemptions that range from paying a substitute to serve on one’s behalf to waivers of service for college students—all of which favor the wealthy and privileged (CBO, 2007, pp. 3-5).

On the surface, the unequal burden hypothesis appears to continue to be true. The 2007 CBO study, however, showed this situation to be diminishing: African Americans were still overrepresented in the force, but underrepresented in new accessions. In addition, the —BO analysis suggests that youths are represented [...] at all socioeconomic levels. However, young people from the lowest income and highest income families are less likely to be represented in the enlisted force than their peers” (CBO, 2007, p. 30). This appears to refute the claim that the very poor are shouldering the majority of the burden. Additionally, —black recruits were more likely to come from the highest black family incomes; a change from earlier in the decade” (CBO, 2007, p. 29). This suggests that the assertion of —economic conscription” (CBO, 1989, p. 9) of minorities may be overstated.

Furthermore, representation in the military does not necessarily equate to —burden” in terms of physical danger and risk of death. In an investigation of the racial and ethnic makeup of the combat operations in Iraq and Afghanistan through December 2006, the 2007 Congressional Budget Office (CBO) study found that while representation in those theaters was an accurate reflection of the racial and ethnic representation in the force,

[W]hite service members have a higher representation in combat operations (75[%]) than in the force as a whole (68[%]), whereas black service members have a lower representation in those occupations (13[%]) than in the overall force (19[%]) [...]. Data on fatalities indicate that minorities are *not* (emphasis added) being killed in those operations at a greater rate than their

representation in the force. Rather, fatalities of white service members have been higher than their representation in the force (76[%] of deaths in those two theaters through December 2006). (CBO, 2007, p. ix)

But even if the burdens of military service are disproportionately shouldered by certain groups, the individuals in those groups receive benefits that might not be available elsewhere (CBO, 1989, p. 11). Even if the claim of economic conscription—where underprivileged youth are forced to choose between enlistment and unemployment—is valid, the alternative may be much worse: unemployment is the only answer (1989, pp. 10-11).

Another benefit to military service is the absence of gender discrimination: —Seven percent of female officers and 34 percent of enlisted women are black compared with 9 percent of male officers and 20 percent of enlisted men [...] many black women see the military as providing greater opportunities and benefits than the civilian labor market” (Segal & Segal, 2004, p. 19).

The numbers on recruitment do not tell the whole story. In fact, when the career force is considered, a different representation tale is told. While African Americans show an increase in proportions from accessions to force structure, women and Hispanics show a decrease. This reflects a disparity in what drives enlistment with what drives retention. Women show a lower propensity to reenlist. If the goal is to raise the proportion of women, or at least to maintain the present level, the military has two options: recruit more women to account for the higher non-reenlistments (a costly proposition) or institute policies to retain more women.

There are limits to the degree to which the military should strive to achieve social equity, however. The nature of its business rightfully excludes certain members of society. The aged, infirm, and the young are three groups that are completely unrepresented in the military. This is because the cost of their presence in terms of lost military effectiveness would far outweigh the benefits to social equity.

E. Military Effectiveness

Approximate representation in terms of Social Equity and Political Legitimacy is desirable and necessary, but only up to the point at which it begins to hinder military effectiveness. Determining where that point lies is beyond the scope of this paper. History, however, has shown that military effectiveness must take precedence over the desire for social equity and political legitimacy when these goals are conflicting.

Examples of this trade-off abound. Women represent almost 50% of the eligible population, yet comprise slightly less than 15% of the active duty force. Since the statutory ceiling on the percentage of women in the force was lifted in 1972, there has been a very slow and calculated increase in the proportion of women who serve. Increasing the percentage of women in the force more quickly would have produced extreme logistical difficulties and hindered the military's ability to achieve its mission. Women are still forbidden to serve in approximately 20% of all military positions, including ground combat units (Segal & Segal, 2004, p. 18). The failure to require women to register for the draft underscores the negative effect that perfect representation would have on military effectiveness. This illustrates the military's deliberate "correction" of social inequity to reflect current attitudes and priorities while preserving military effectiveness.

Minimum education, physical, and moral standards are required for enlistment. Relaxing these standards would most likely increase the level of representation of certain groups, but at a cost to effectiveness that is unacceptable to decision-makers. The 1989 CBO report shows that more than 90% of total-force recruits were high school graduates, compared with the less than 80% graduation rate of their civilian counterparts. Additionally, a force that perfectly represented the Nation in terms of aptitude would include 23% of the Nation's youths who scored between 10 and 30 on the Armed Forces Qualification Test (AFQT). Currently, the service-wide average is less than 10% of those individuals. United States law forbids joining by those that score below 10 on the AFQT. Education and aptitude are currently the best measures of effectiveness available. Therefore, the CBO

explains, —military effectiveness now argues for maintaining the clearly unrepresentative nature, in terms of education and test scores, of the recruits being brought in under the All Volunteer Force [which is unrepresentative in those terms]” (1989, p. 8). These findings continue in the CBO 2007 report: —In 2006, 69[%] of recruits scored at or above the [50th] percentile [category IIIA and above], relative to the overall United States youth population” (pp. 15-16). This assertion is supported by the CBO’s 2007 report that states that the percentage of enlistees with High School Diplomas continues to outpace the civilian population by the same degree.

F. Accession Representation versus Force Representation

Certainly, recruitment representation is important in any analysis of the demographic shape of today’s military. It, however, only tells part of the story. The make-up of the career force is equally, if not more, important and is a related consequence of the composition of accessions. Today’s career force does not look the same as the accessions that feed it, however. There is a disconnect between incentives to join the military and decisions to stay in the military. African Americans are under-represented in terms of accessions (13% in 2005), but overrepresented in terms of career force (19% in 2006) compared to 14% of the overall population. Women joined at a rate of 16.5%, yet, in 2004, the total force percentage was only 14.8%. In 2004, 12.9% of accessions were Hispanic, yet only 9.8% of the total force was represented, compared to that ethnicity contributing to 16.4% of the eligible population (OSD(P&R), 2005a). In force-shaping endeavors, the Navy must determine why this disparity occurs and strive to provide reenlistment incentives to achieve the optimal mix of recruits.

G. CRAM’s Force-diversification Potential: Enlisted Survey⁷

For a 25% retention rate, 151 of 604 Sailors were retained under all retention mechanisms simulated. Under the CRAM auction, depending on the NMIs offered, a different set of Sailors was retained. This contrasts with those retained under the

⁷ There was insufficient data to replicate this analysis for the SWO survey. This discussion pertains specifically to the enlisted survey, though the general issues cross all Navy populations.

strictly monetary retention auction. Some Sailors were present in both groups (overlap). For example, when all 13 NMIs were offered, the overlap was 45 Sailors. This means 106 different Sailors were retained by offering NMIs. But, who are these Sailors and how does their retention affect the demographic composition of the fleet?

To test the effects of offering different combinations of NMIs, five CRAM auctions were simulated. The researchers adjusted the offerings to produce the largest positive increase in the following groups: females, African Americans (black), Hispanics, Sailors with an Associate's Degree or higher, and Sailors age 27 and under. As costing data was unknown, the cost of incentives was assumed to be zero to fully compare relative values. The 25% retention rate was used to capture the individuals with the highest values for the individual NMIs.

The sample was too small and narrow to prove any differences statistically significant or applicable to the entire enlisted force, but the findings deserve mention and further study. Appendix H contains results of selected NMI combinations and their impacts on representation by gender, race/ethnicity, education level, and age. Note: there are cases when the results from this sample show a decrease in retention of certain protected groups. Policy-makers must be careful to ensure that offering NMIs does not have an adverse impact on diversity.

1. Gender

By offering choice of homeport and billet only, CRAM produced the largest positive change in female representation. This group increased five percentage points from 16% of those retained to 21%. This resulted in just over a 30% increase in retention. This implies, for this sample, homeport and billet choices are the most valuable non-monetary incentives to these women. While sabbatical, telecommuting, and compressed workweek did not produce the largest increase, the inclusion of these benefits also increased female retention, as shown in Table 7.

Table 13. Gender Representation with CRAM

Gender	SRB Only	HP, Billet	HP, Billet, Sabbatical	HP, Billet, Telecomm	HP, Billet, Compressed Week	All 5
Female	16%	21%	19%	18%	19%	17%
Male	81%	77%	79%	81%	79%	82%
No Answer	3%	2%	2%	1%	2%	1%

In this sample, almost 53% of the females were ACs. Under the monetary auction, the retained female ACs represented just over 20% of the females in the sample. When the five NMIs listed in Table 5 were offered, the female ACs retained represented only 16% of the females in the sample. Put another way, representation of retained female FCs increased—from just over 5% of the females in the sample to almost 11%. With only choice of homeport and billet offered, ACs represented 24% of the females and FCs just fewer than 10%. This may be because the benefits offered under sabbatical, telecommuting, and compressed workweek are more appealing to FC women as their rate spends 70% of its time at sea. Or it could be that female ACs do not find these options necessary or feasible, as they are in a shore-intensive, fixed-schedule job. In any case, the results may not be applicable to the entire enlisted population. This underscores the necessity of a more rigorous analysis involving a larger and more diverse sample.

2. Race/Ethnicity

Two demographic groups were identified for these simulations: African American (black) and Hispanic.

a. African American

Figure 35 compares the results of a monetary-only auction and a CRAM auction offering choice of homeport, compressed workweek and lump-sum SRB. Again, the results show an increase in the percentage of blacks retained—implying, for this sample, that these NMIs are the most valuable to this demographic group.

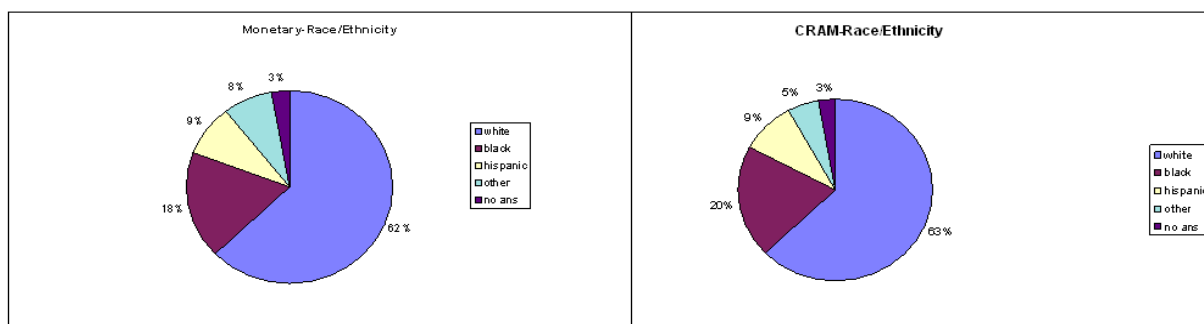


Figure 35. Black Representation with CRAM

b. Hispanic

For Hispanics in this sample, the most valuable NMIs appeared to be choice of platform, two-tour geographic stability, professional certification and lump-sum SRB. Figure 36 displays the contrast in representation between the monetary-only auction simulation and the CRAM auction with the above offerings. The increase in Hispanic representation is just over 44%.

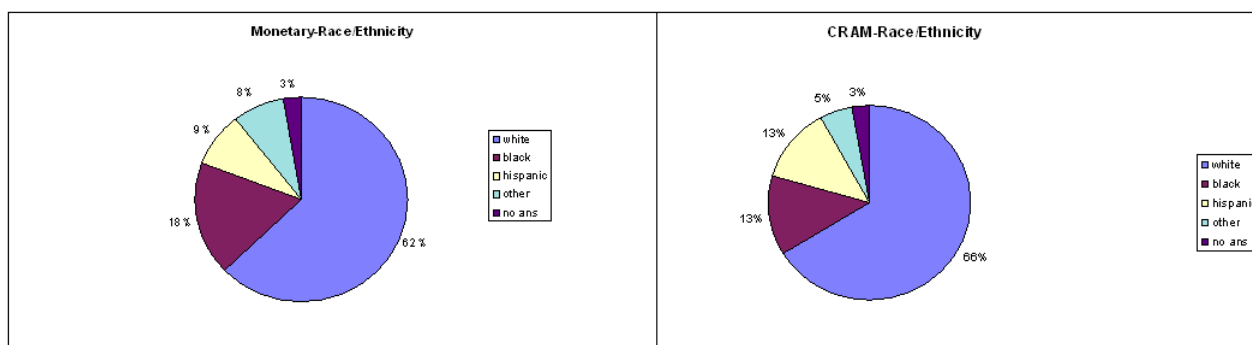


Figure 36. Hispanic Representation with CRAM

3. Education

If the Navy is to attract personnel with higher levels of education, the results of this sample's CRAM auction suggest that offering a choice of homeport, choice of platform, sabbatical, telecommuting, compressed work week, a barracks room while on sea duty, and a lump-sum SRB could increase the representation of this group. In this sample, the percent of retained Sailors with an Associate's Degree or higher increased from 23% to 36%—an increase of 52%. Figure 37 shows these results.

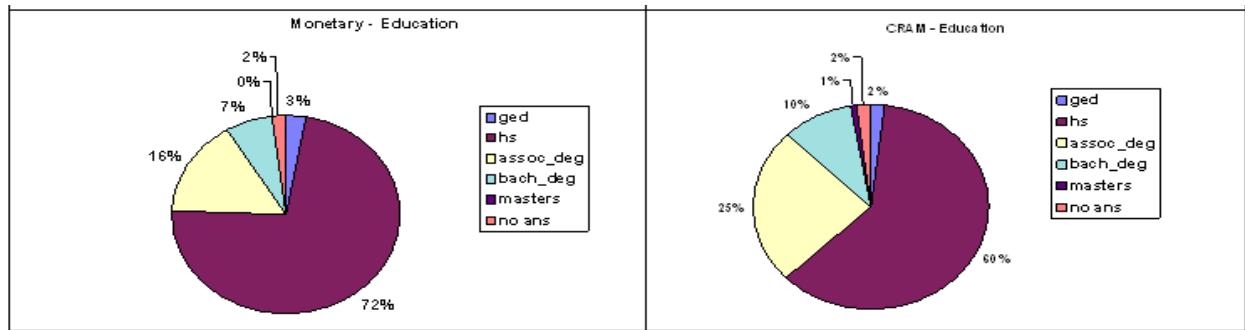


Figure 37. Education Level Representation with CRAM

4. Age

The respondents were grouped into four different age groups representing three “generations”: Baby Boomers (those over 42), Generation X (age 28-42), and Generation Y (age 21-27 and those under 21). According to the 2005 *Population Representation in the Military Services* (OSD(P&R), 2005a), Generation Y Sailors comprise 62% of the force; Generation X accounts for almost 35%; and the remaining 3% consist of Baby Boomers. The representation of Generation Y Sailors will only increase as the Baby Boomers and older Generation X Sailors retire. The sample from the Enlisted Retention Survey was almost 57% Generation Y, 40% Generation X, and just over 2% Baby Boomers.

As Figure 38 illustrates, 45% of retained Sailors—retained with a monetary-only incentive—were from Generation Y. With a CRAM auction offering choice of platform, choice of billet, sabbatical, telecommuting, three-tour geographic stability, professional certification, compressed work week, a barracks room while on sea duty, and lump-sum SRB, 50% of those retained were from this generation.

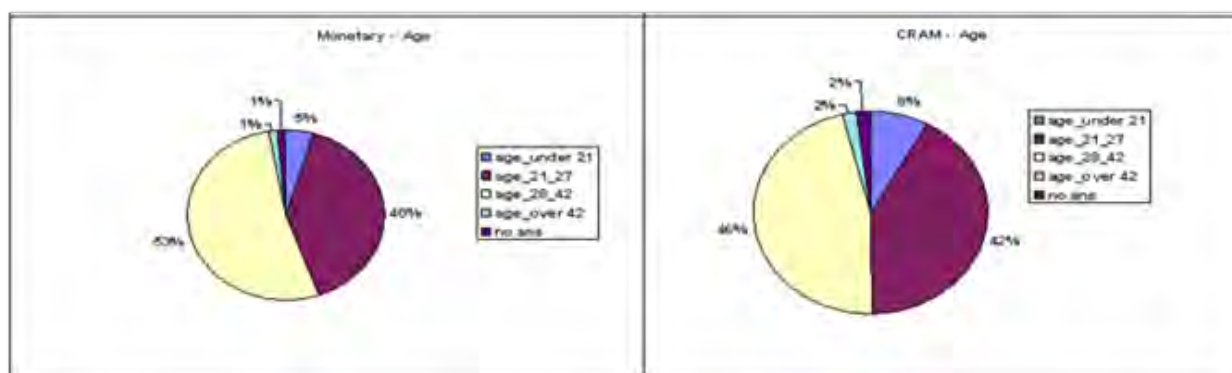


Figure 38. Age Representation with CRAM

H. Summary

This chapter demonstrates CRAM's potential as a force-diversification tool, although it only addresses diversity in terms of retention—not accessions, attrition, or promotion—and only has been applied to the enlisted populations surveyed here. It is important to note that CRAM achieves enhanced diversity without giving particular retention preference to any group. It simply offers what is most important to its members in the hopes of increasing their retention.

The reader should nonetheless realize that these results are not conclusive. The sample is too small and narrow in scope for statistical inference. The results do, however, show CRAM's potential effect on population representation.

VIII. Summary, Conclusions, and Recommendations

A. Summary

This research addressed the potential retention and cost impacts of providing an optimal individualized portfolio of non-monetary and monetary incentives to influence reenlistment and retention behavior in SWOs and enlisted Sailors.

The SWO and Enlisted Retention Survey and subsequent auction simulations showed:

1. A combinatorial auction mechanism providing individualized portfolios of non-monetary and monetary incentives, promising a more cost-effective means to influence reenlistment/retention behavior over monetary incentives alone.
2. A way to determine the optimal mix of monetary/non-monetary incentives that would be both valued by Sailors and cost-effective for the Navy.
3. An auction design that would allow the Navy to tailor monetary/non-monetary reenlistment incentive packages to individual Sailors while simultaneously economizing Navy resources.
4. The potential cost savings the Navy might expect by moving from purely monetary reenlistment incentives to a portfolio of monetary/non-monetary incentives—if both reenlistment incentive programs are optimally designed.
5. How population representation might be affected by offering these reenlistment incentives.

This report focused on exploring three mechanisms for administering enlisted retention: a purely monetary auction, a Universal Incentive Package (UIP) auction, and the Combinatorial Retention Auction Mechanism (CRAM).

The mechanisms were simulated, their outcomes compared, and their respective strengths and weaknesses explored. CRAM clearly outperformed the monetary and UIP auctions. Cost savings to the Navy ranged from 6% – 42% over monetary incentives in the SWO survey and from 25% – 80% in the Enlisted survey.

While the UIP was shown to be simpler in implementation than the version of CRAM simulated here, the potential for a significant deficit (with UIP) was illustrated both conceptually and in the simulations. While not the focus of this research, CRAM auction variants can be designed to simplify implementation while retaining the essential CRAM performance characteristics, as discussed below in the implementation section. The final product is a retention approach that is applicable to any community (enlisted or officer, surface or aviation) by simply changing the offerings and associated reservation values.

Additionally, this research addressed the force-diversifying potential of CRAM. For the Enlisted sample used, it was shown that offering certain non-monetary incentives changed the demographic mix of Sailors retained. Due to the small sample size, these results are not conclusive, but do provide support for further research.

Another benefit of CRAM that can perhaps not be quantified is the psychological benefits of choice. If Sailors were able to choose the benefits that best suit them, they would be more likely to recognize the true composition of their total rewards package and may also realize an increase in value by having a voice in their compensation. By allowing Sailors to choose only those benefits which suit them, the Navy can eliminate the waste associated with unwanted benefits while empowering its members.

B. Conclusions

There already exists substantial research that supports the effectiveness of a Total Rewards approach to compensation. There is also evidence that an auction mechanism to determine proper bonus levels would be beneficial to manpower analysts. This research combines these two notions into a tool for planners to effectively and efficiently manage retention and reenlistment behavior.

C. Recommendations

1. Implementation

The essential element in a combinatorial auction is variability in preferences. There are several sources of variability in preferences. These include:

1. Variability across NMIs (on average, some are more valuable than others).
 - a. NMIs should be selected carefully.
2. Variability across populations (on average; different populations may prefer different NMIs).
 - a. NMIs offered should vary across populations (e.g., SWOs versus enlisted Sailors).
3. Variability within a population (individuals within a population value NMIs differently).
 - a. Individualized NMI packages are more effective than universal packages.
4. Variability within the individual (values for combinations of NMIs may be additive, super-additive or sub-additive relative to the values for the individual NMIs in that package).
 - a. CRAM must consider the information elicitation issue (do we need values for all incentives and potential packages?).

The CRAM variant described in this research addresses all four of these preference variability issues. In contrast, UIP can address the first two issues—variability across NMIs and variability across populations—as long as NMIs are selected carefully and are targeted to individual populations (which does not seem to be the case to date in military applications). However, the CRAM variant described here, which can be considered the “full-information” CRAM, is information intensive; it assumes an auction developer has full information about each Sailor’s value for the individual incentives and every possible combination of incentives. Unfortunately, the value of NMI combinations is not always the sum of values for the individual NMIs. Combination values can be super-additive if the NMIs are complements, or sub-additive if the NMIs are substitutes. The SWO and Enlisted

survey data shows significant incidence of all three cases: additive, super-additive and sub-additive preferences.

Further research will explore the implications of variability in NMI values within the individual. In particular, it will explore the feasibility of simply assuming preferences are additive across combinations. The risk is that some individuals with super-additive preferences may not be retained when they would choose to be retained and that the Navy will expect to retain some individuals with sub-additive preferences when they will choose not to be retained. However, the extent of this problem is questionable and amenable to empirical analysis; assuming that NMI values are additive may be a workable simplification. Preliminary work on preference elicitation indicates that there is little effect on the final outcome if the auction is implemented assuming additive valuations (Ellis, 2009).

An alternative way to implement CRAM would be a “~~choice~~ criteria-style” plan in which Sailors are given a menu of NMIs along with their associated costs. Each Sailor would select which NMIs to include in his/her retention package. The Sailor would understand that the listed cost for any NMI selected would be added to his requested SRB amount to determine his total retention cost (and, thus, his likelihood of being retained). Each Sailor would be best served by selecting only the NMIs he values as much or more than their cost. After choosing from the available NMIs, each Sailor would then submit a cash bid indicating the minimum amount he would require for reenlistment, given that he would also receive his selected NMIs.

A further extension of this system is a two-phase reenlistment process. Sailors would bid on the NMIs in an open auction for the six months prior to their retention season. After “winning” his provisional NMIs, a Sailor would participate in the next season’s retention auction, bidding for retention with his individualized package of incentives.

After identifying the advantages and disadvantages of alternative approaches to implementing CRAM, the authors suggest implementing these auctions on a small scale, with one or two ratings, in a pilot program. This approach will allow planners

and participants to become comfortable with the new system and to work out any issues that may arise.

Implementation of a Navy-wide retention auction would require substantially reworking the current reenlistment system. Mass reenlistment — ~~seasons~~ “seasons” would have to be established to obtain sufficient numbers for each auction. A Sailor could still maintain his current end of obligated service (EAOS), but he would be required to commit to additional obligated service during the reenlistment season prior to his EAOS. An example would be quarterly reenlistment seasons (e.g., in January, April, July and September). If a Sailor’s EAOS was May 8, he would be required to participate in the January reenlistment season auction and commit, at that time, to reenlisting on or before May 8. This system would have an additional benefit of preventing billet gaps that ensue from unplanned EAOS losses.

2. Further Research

Further research is definitely warranted. The data used in the simulations was relatively small, and the scope was relatively narrow (junior SWOs, E-6 and below Navy ACS and FCs). The model itself, however, can easily be adapted to accommodate a larger sample and more diverse group. The authors suggest administering further Navy-wide retention surveys, similar to those in Appendices A and B, to obtain value distributions for additional populations that can be used for statistical inference.

Accurate cost data is also essential to determine this mechanism’s cost-saving potential. Research is presently ongoing to discover these costs. This research assumed constant marginal costs for all NMIs and based NMI costs on the distribution of NMI values. The primary issue to resolve is the constant marginal cost assumption. If marginal costs increase with usage, the CRAM model would be more complicated to implement. If appropriate, an increasing marginal cost CRAM variant will be developed.

Finally, further work is needed to identify the CRAM variant that balances fidelity of the results with ease of implementation. This will require exploring whether

it is appropriate to assume additive preferences and to compare those results to the Menu CRAM. Experiments to verify the mechanism's performance are also warranted. These investigations should precede any pilot test.

Providing a Total Rewards package—including monetary and non-monetary benefits individually tailored to meet the needs of each individual Sailor—is a lofty goal. However, it is attainable and worth the effort. Using CRAM, the Navy can potentially save hundreds of thousands of dollars in wasted benefits and empower its members by giving them a voice in their compensation: a “win-win” situation.

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Appendix A. SWO Retention Survey

1. Participant Consent Section

Naval Postgraduate School Participant Consent and Risk Management Statement

Introduction: We invite you to participate in our survey entitled "Surface Warfare Officers Survey" being conducted by the Naval Postgraduate School of Business and Public Policy. We appreciate your participation in assessing the current and future state of Surface Warfare Officer Continuation Pay.

Compensation: No tangible rewards will be given for completion of this survey. Results of the survey will be available for review upon research completion.

Procedures: If you agree to participate in the survey, please complete the survey. The survey will take approximately 10 minutes to complete. Please read each question carefully prior to answering. Questions 14-18 require actual dollar amounts as answers.

Confidentiality and Privacy Act: Results of this survey will be kept confidential and all privacy will be safeguarded. Personal identity will not be compromised as a result of participating in this survey.

Points of Contact: Should you have any questions or comments regarding this survey, please contact the Principal Investigator Bill Gates, (831) 656-2754, bgates@nps.edu. Any other questions or concerns may be addressed to the IRB Chair, LT Brent Olde, (831) 656-3807, baolde@nps.edu.

Consent: I have read and understand the above information. My participation is completely voluntary, and I have the right to withdraw at any time without penalty or obligation. I have asked all questions and have had my questions answered. I agree to participate in this study. I will be provided a copy of this form for my records.

2. Survey

1. I agree to participate in this survey?

- ☐ A. Yes
☐ B. No

2. What is your current marital status?

- ☐ A. Single, never married
☐ B. Married
☐ C. Married to military member
☐ D. Divorced, Separated, Widowed

3. How many dependents (not including your spouse) do you have?

- ☐ A. 0
☐ B. 1-2
☐ C. 3-4
☐ D. 5 or greater

4. What was your commissioning source?

- ☐ A. United States Naval Academy
- ☐ B. Officer Candidate School
- ☐ C. Naval Reserve Officer Training Corps (NROTC)
- ☐ D. Limited Duty Officer
- ☐ E. STA-21

5. What is your current paygrade?

- ☐ A. O-1E
- ☐ B. O-1
- ☐ C. O-2E
- ☐ D. O-2
- ☐ E. O-3E
- ☐ F. O-3
- ☐ G. O-4

6. Where are you currently serving?

- ☐ A. Sea
- ☐ B. Shore

7. In which fleet is your homeport?

- ☐ A. COMSECONDFLT (Norfolk/Mayport/Ingleside)
- ☐ B. COMTHIRDFLT (San Diego/Everett/Pearl)
- ☐ C. COMFIFTHFLT (Bahrain)
- ☐ D. COMSIXTHFLT (Naples)
- ☐ E. COMSEVENTHFLT (Yokosuka/Sasebo/Guam)

8. How many years of active duty service have you completed?

- ☐ A. 0-5 years
- ☐ B. 6-10 years
- ☐ C. 11 years or more

9. What is your ethnic descent?

- ☐ A. White/Caucasian
- ☐ B. Black/African American
- ☐ C. Asian/Pacific Islander
- ☐ D. Native American/Aleut/Eskimo
- ☐ E. Spanish/Hispanic/Latino

Other (please specify)

10. How would you describe your current level of job satisfaction?

- ☐ A. Very satisfied
☐ B. Satisfied
☐ C. Somewhat Satisfied
☐ D. Dissatisfied

11. Rank the following factors below in order of importance when deciding on permanent change of station orders.

	Not Important		Neutral		Very Important
Platform Type (CG, DDG, FFG, LSD, LPD)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Location (Homeport)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Billet (OPS, WEPS, CSO, 1ST LT, CHENG)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Housing Availability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Education Opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Impact of Permanent Change of Station on Family Members (Spouse Job Relocation, Schools, and Childcare)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promotion/Professional Opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. What is the highest level of education you have completed?

- ☐ A. Bachelors Degree
☐ B. Graduate Degree
☐ C. Professional Degree (Ph.D.)

13. What was/will be your primary reason for accepting or declining the Surface Warfare Officer bonus?

14. How much money in dollars would you require to commit to two Department Head tours? If there is no amount of money that would persuade you to commit to Department Head tours, please enter "none".

15. Assuming the initial bonus you specified is available to you, how much in dollars would you be willing to give up, if you were guaranteed the following:

Homeport
Ship Type
Billet

16. Assuming the initial bonus you specified is available to you, how much in dollars would you be willing to give up, if guaranteed the following:

Homeport and Billet
Homeport and Ship
Ship Type and Billet
Homeport, Billet, and Ship Type

17. Assuming the initial bonus you specified is available to you, how much in dollars would you be willing to give up if guaranteed the following: a one year sabbatical, telecommuting, or geographical stability.
(Sabbatical is defined as an unpaid year to spend as you wish, while retaining benefits. Telecommuting would allow you to work from home on scheduled days. Geographical stability allows personnel to serve three consecutive years in the same geographical region.)

One Year Sabbatical
Telecommuting
Geographical Stability

18. List any other incentive(s) that the Navy can offer and the amount of the bonus that you would give up to receive that incentive. "Out of the box" answers are encouraged and accepted. (Example: Designated Parking Spot- \$1,000 dollars)

Appendix B. Enlisted Retention Survey

Naval Postgraduate School Participant Consent and Risk Management Statement

Introduction:

We invite you to participate in our survey entitled "Non-Monetary Retention Incentives Survey" being conducted by the Naval Postgraduate School of Business and Public Policy.

We appreciate your participation in assessing the current and future state of Naval Enlisted Personnel Reenlistment Incentives.

The purpose of this survey is to assess how much you would value the included non-monetary benefits if they were offered as a part of your reenlistment package. Their inclusion in this survey does not imply that they will be offered in the future.

Compensation:

No tangible rewards will be given for completion of this survey. Results of the survey will be available for review upon research completion.

Procedures:

If you agree to participate in the survey, please complete the survey. The survey will take approximately 10 minutes to complete. Please read each question carefully prior to answering. Questions 4-12 require actual dollar amounts as answers.

Confidentiality and Privacy Act:

Results of this survey will be kept confidential and all privacy will be safeguarded. Personal identity will not be compromised as a result of participating in this survey.

Points of Contact:

Should you have any questions or comments regarding this survey, please contact the Principal Investigator Bill Gates, (831) 656-2754, bgates@nps.edu. Any other questions or concerns may be addressed to the Institutional Review Board Chair, LT Brent Olde, (831) 656-3807, baolde@nps.edu.

Consent:

I have read and understand the above information. My participation is completely voluntary, and I have the right to withdraw at any time without penalty or obligation. I have asked all questions and have had my questions answered. I agree to participate in this study. I will be provided a copy of this form for my records.

Survey Questions

1. I agree to participate in this survey?

☐ A. Yes

☐ B. No

2. How would you describe your current level of job satisfaction?

☐ A. Very Satisfied

☐ B. Satisfied

☐ C. Somewhat Satisfied

☐ D. Somewhat Dissatisfied

☐ E. Dissatisfied

☐ F. Very Dissatisfied

3. What was/will be your primary reason for accepting/declining the Selective Reenlistment Bonus (SRB), if offered?

A. Reason
for

Accepting

B. Reason

for

Declining

The following questions allow you to place a dollar value on the included non-monetary benefits by establishing a baseline dollar amount (SRB) you would require for reenlistment (question 4) and then asking how much in dollars of that bonus you would be willing to give up to receive the indicated non-monetary benefit.

These values are critical to establishing the cost-effectiveness of offering each benefit.

4. What is the minimum amount of money (in dollars) you would require as a total Selective Reenlistment Bonus (SRB) payment (above and beyond your salary and other pays) to commit to 4 more years of active duty?

- ☐ A. I would reenlist even if no SRB were offered.
- ☐ B. No amount of money would entice me to reenlist.
- ☐ C. I would require a minimum of \$_____ to reenlist for 4 years.

Each letter option in each question (5-11) should be considered separately.

5. Assuming the SRB amount you specified is available to you, how much of this bonus (in dollars) would you be willing to give up if you were guaranteed the following:

- A. Homeport of Your Choice _____
- B. Platform Type of Your Choice _____
- C. Billet Type of Your Choice _____

6. Assuming the SRB amount you specified is available to you, how much of this bonus (in dollars) would you be willing to give up if you were guaranteed the following:

- A. One Year Sabbatical (sabbatical is defined as an unpaid year to spend as you wish, while retaining benefits, but not accruing retirement time) _____
- B. Telecommuting (telecommuting would allow you to work from home on scheduled days) _____
- C. Geographic Stability – 2 tours (average 6 years) (geographic stability allows personnel to serve two consecutive tours in the same geographic area) _____
- D. Geographic Stability – 3 tours (average 9 years) (geographic stability allows personnel to serve three consecutive tours in the same geographic area) _____

7. Assuming the SRB amount you specified is available to you, how much of this bonus (in dollars) would you be willing to give up if you were guaranteed the following:

- A. Professional Certification Program in your rating _____
- B. Compressed work schedule (a compressed work schedule allows personnel to fulfill their work-hours obligation by working longer hours in fewer days; for example five 8-hour days could be compressed into four 10-hour days) _____
- C. Transferability of GI Bill benefits (to spouse or child) _____

8. Assuming the SRB amount you specified is available to you, how much of this bonus (in dollars) would you be willing to give up, if you were guaranteed the following while assigned to a ship (please indicate if Not Applicable to you (for example, you already receive BAH while assigned to a ship)):

A. Single Barracks Room while in port

B. Basic Allowance for Housing (BAH)

9. Assuming the SRB amount you specified is available to you, how much of this bonus (in dollars) would you be willing to give up, if you were offered a single, lump sum payment of your SRB instead of the existing policy? The existing policy calls for fifty percent of the SRB to be paid at the time of reenlistment with the remaining fifty percent paid in equal annual installments each October over the contract period. For example, a four year reenlistment contract would have one lump sum payment of fifty percent and three annual installments (OPNAVINST 1160.8A).

10. Assuming the SRB amount you specified is available to you, how much of this bonus (in dollars) would you be willing to give up if you were guaranteed the following:

A. Homeport of Your Choice and Geographic Stability (2 tours)

B. Homeport of Your Choice and Compressed Work Week

C. Geographic Stability (2 tours) and Compressed Work Week

D. Homeport of Your Choice, Geographic Stability (2 tours) and Compressed Work Week

11. Assuming the SRB amount you specified is available to you, how much of this bonus (in dollars) would you be willing to give up if you were guaranteed the following:

A. Lump Sum SRB and Telecommuting

B. Lump Sum SRB and Homeport of Your Choice

C. Telecommuting and Homeport of Your Choice

D. Lump Sum SRB, Telecommuting and Homeport of Your Choice

12. Assuming the SRB amount you specified is available to you, how much of this bonus (in dollars) would you be willing to give up if you were guaranteed your choice of two of the following, please indicate which two you would choose.

Please Check Two Options:

- ☐ A. Homeport of Your Choice
- ☐ B. Platform Type of Your Choice
- ☐ C. Billet Type of Your Choice
- ☐ D. One Year Sabbatical
- ☐ E. Telecommuting
- ☐ F. Geographic Stability (2 tours)
- ☐ G. Geographic Stability (3 tours)
- ☐ H. Professional Certification Program
- ☐ I. Compressed Work Schedule
- ☐ J. Guaranteed Barracks Room while In-Port
- ☐ K. BAH while on sea duty
- ☐ L. Lump sum SRB
- ☐ M. Transferability of GI Bill benefits (to spouse or child)

*****Dollar Value (of SRB) you would be willing to give up for the checked options:**

13. Assuming the SRB amount you specified is available to you, how much of this bonus (in dollars) would you be willing to give up if you were guaranteed your choice of three of the following, please indicate which three you would choose.

Please Check Three Options:

- ☐ A. Homeport of Your Choice
- ☐ B. Platform Type of Your Choice
- ☐ C. Billet Type of Your Choice
- ☐ D. One Year Sabbatical
- ☐ E. Telecommuting
- ☐ F. Geographic Stability (2 tours)
- ☐ G. Geographic Stability (3 tours)
- ☐ H. Professional Certification Program
- ☐ I. Compressed Work Schedule
- ☐ J. Guaranteed Barracks Room while In-Port
- ☐ K. BAH while on sea duty
- ☐ L. Lump sum SRB
- ☐ M. Transferability of GI Bill benefits (to spouse or child)

***Dollar Value (of SRB) you would be willing to give up for the checked options:

|

14. List any other non-monetary incentive(s) that the Navy could offer which would be attractive to you and the amount of the bonus (in dollars) you would be willing to give up to receive that incentive. "Out of the box" answers are encouraged and accepted. (Example: Designated Parking Spot \$1000.00)

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The following demographic questions are necessary for data/trend analysis. This information will not be used to identify individuals.

15. What is your age?

- ☐ A. Under 21
- ☐ B. 21-27
- ☐ C. 28-42
- ☐ D. Over 42

16. What is your current marital status?

- ☐ A. Single, never married
- ☐ B. Married
- ☐ C. Married to military member
- ☐ D. Divorced, Separated, Widowed

17. What is your gender?

- ☐ A. Male
- ☐ B. Female

18. What is the highest level of education you have completed?

- ☐ A. GED or equivalent
- ☐ B. High School
- ☐ C. Associates Degree
- ☐ D. Bachelors Degree
- ☐ E. Masters or Higher

19. How many dependents (not including your spouse) do you have?

- ☐ A. 0
- ☐ B. 1-2
- ☐ C. 3-4
- ☐ D. 5 or greater

20. What is your current paygrade?

- ☐ A. E-1 – E-3 (undesignated)
- ☐ B. E-1 – E-3 (designated)
- ☐ C. E-4
- ☐ D. E-5
- ☐ E. E-6
- ☐ F. E-7 or above

21. What is your current rating?

- ☐ A. AC
- ☐ B. FC
- ☐ C. FC (AEGIS)
- ☐ Other (please specify)

22. What NECs do you hold?

23. Where are you currently serving?

- ☐ A. Sea
- ☐ B. Shore
- ☐ C. Overseas
- ☐ D. Student
- ☐ E. Individual Augmentation (IA) – please give location and length of IA

24. Have you ever been assigned an IA? If yes, when, where and for how long? (excluding present duty)

25. Which fleet is your homeport?

- ☐ A. COMSECONDFLT (Norfolk/Mayport/Ingleside)
- ☐ B. COMTHIRDFLT (San Diego/Everett/Pearl)
- ☐ C. COMFIFTHFLT (Bahrain)
- ☐ D. COMSIXFLT (Naples)
- ☐ E. COMSEVENTHFLT (Yokosuka/Sasebo/Guam)
- ☐ F. Other (please specify) _____

26. How many years of active service have you completed?

- ☐ A. 0-2 years
- ☐ B. more than 2 but less than 4
- ☐ C. more than 4 but less than 6
- ☐ D. more than 6 but less than 10
- ☐ E. 10 years or more

27. What is your race/ethnic descent?

- ☐ A. White/Caucasian
- ☐ B. Black/African American
- ☐ C. Asian/Pacific Islander
- ☐ D. Native American/Aleut/Eskimo
- ☐ E. Spanish/Hispanic/Latino
- ☐ F. Other (please specify) _____

28. What is your home of record (state/country)?

***Home of record is where you were living when you enlisted.**

Thank you for participating in our survey!

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Appendix C. SRB and NMI Value Distributions

For presentation purposes, all figures were truncated at 40% on the vertical axis. On the horizontal axis, the SRB Requirements Distribution display was truncated at \$150,000, and the Value Distribution displays were truncated at \$30,000. Percent of Responses used all observations.

Mean and maximum values were calculated excluding outliers where indicated (*). Outliers were defined as SRB Requirements of \$500,000 and above and NMI Values of \$100,000 and above. There were three observations in the enlisted survey that contained outlier values. There were seven individual NMI outlier values in this survey: one each for homeport choice, billet choice, telecommuting, three-tour geographic stability, professional certification, and two for platform choice. The SWO survey included a smaller sample of NMIs.

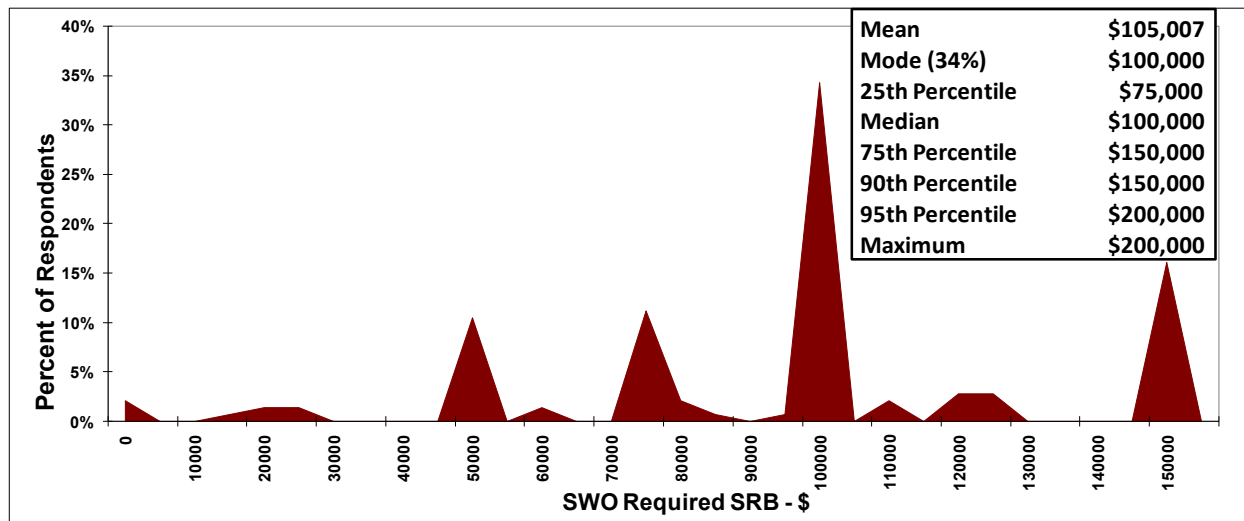


Figure 39. SWO Required SRB Distribution

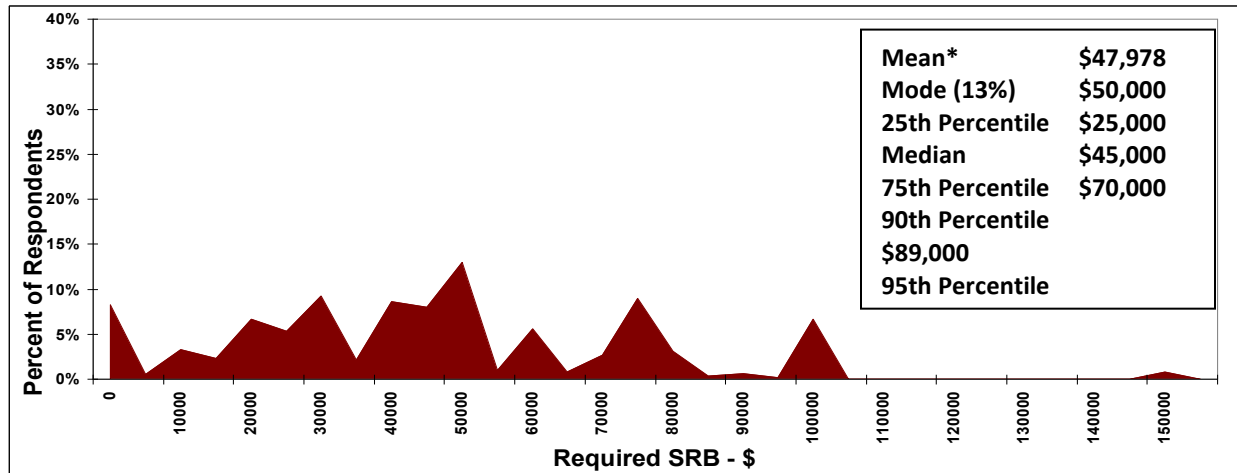


Figure 40. Enlisted Required SRB Distribution

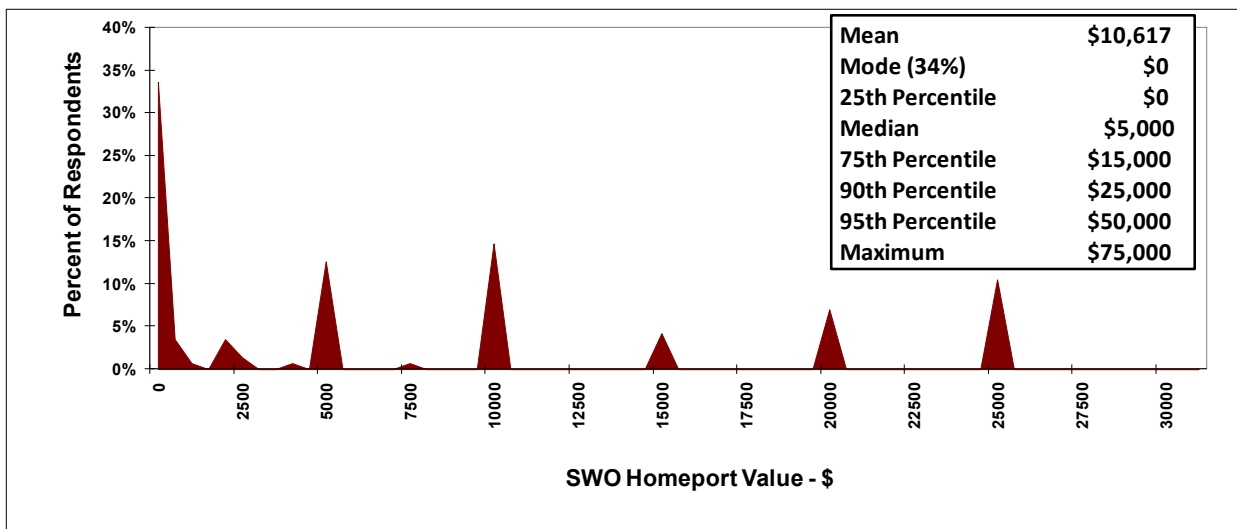


Figure 41. SWO Homeport Value Distribution

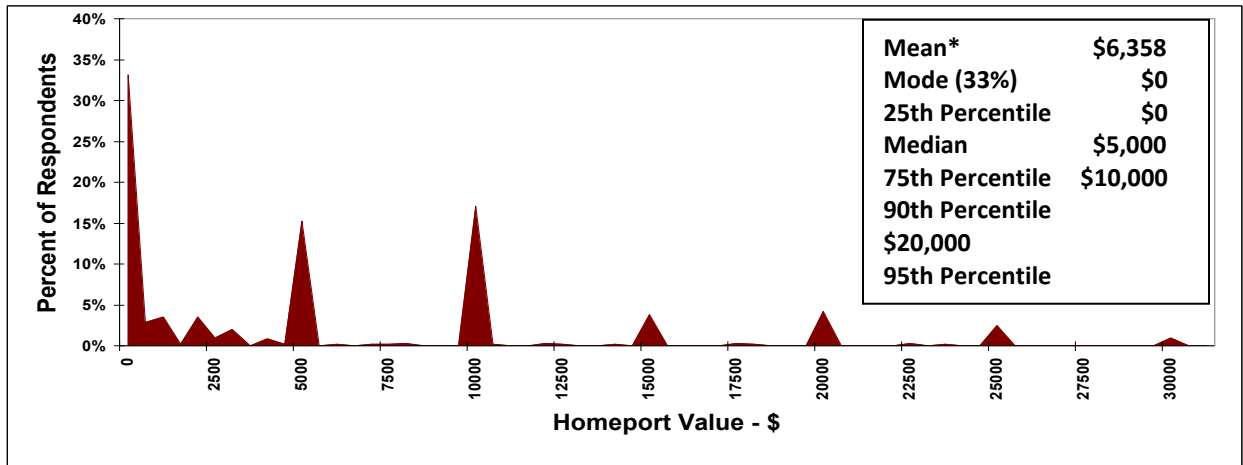


Figure 42. Enlisted Homeport Value Distribution

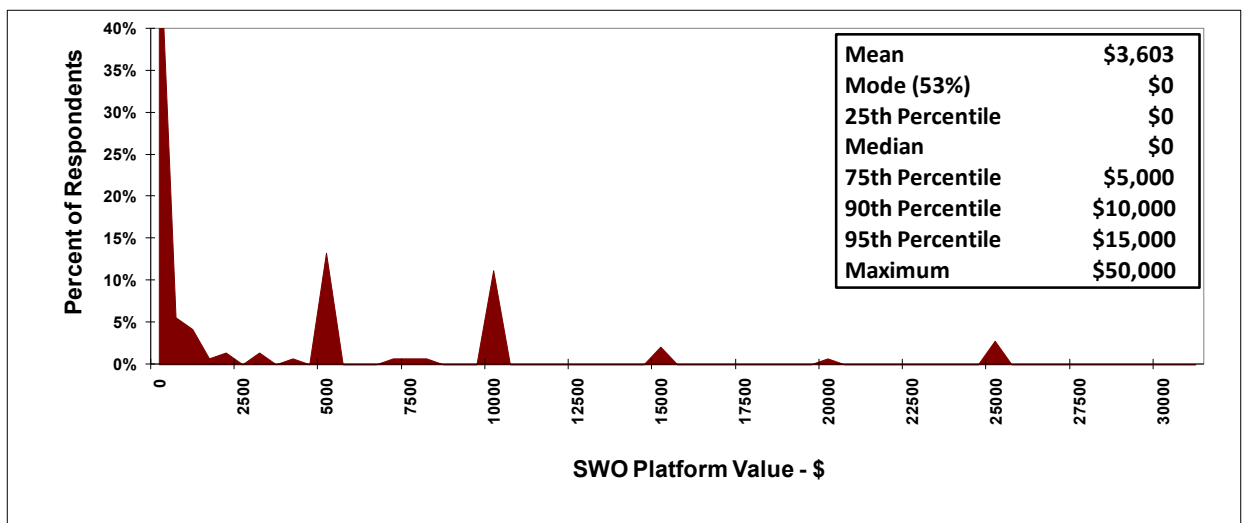


Figure 43. SWO Platform Value Distribution

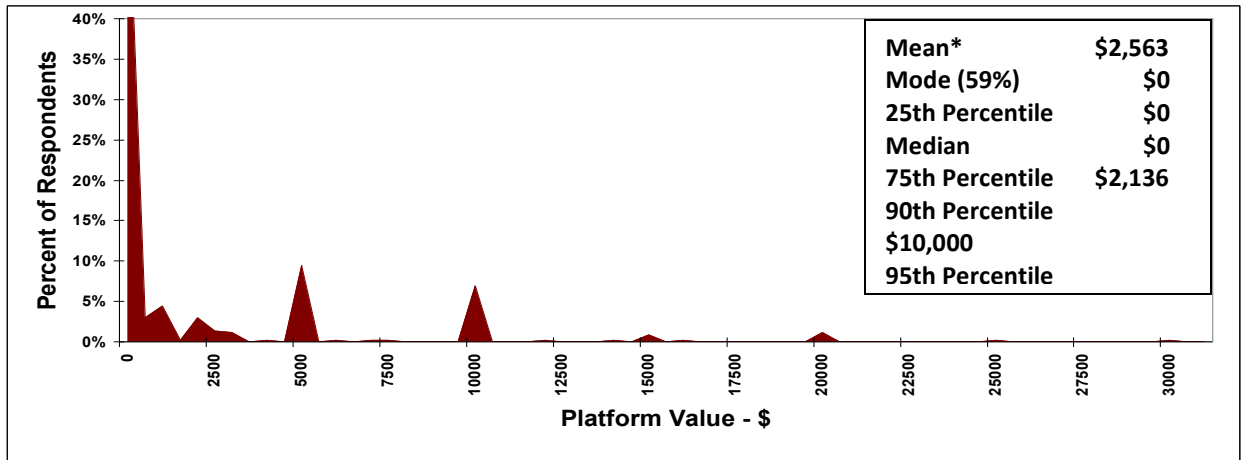


Figure 44. Enlisted Platform Value Distribution

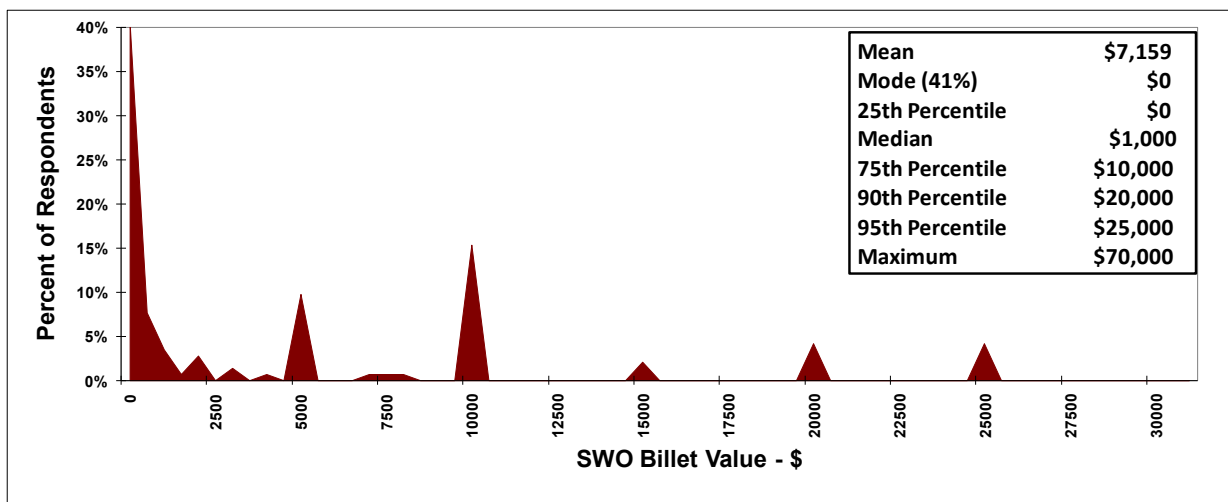


Figure 45. SWO Billet Value Distribution

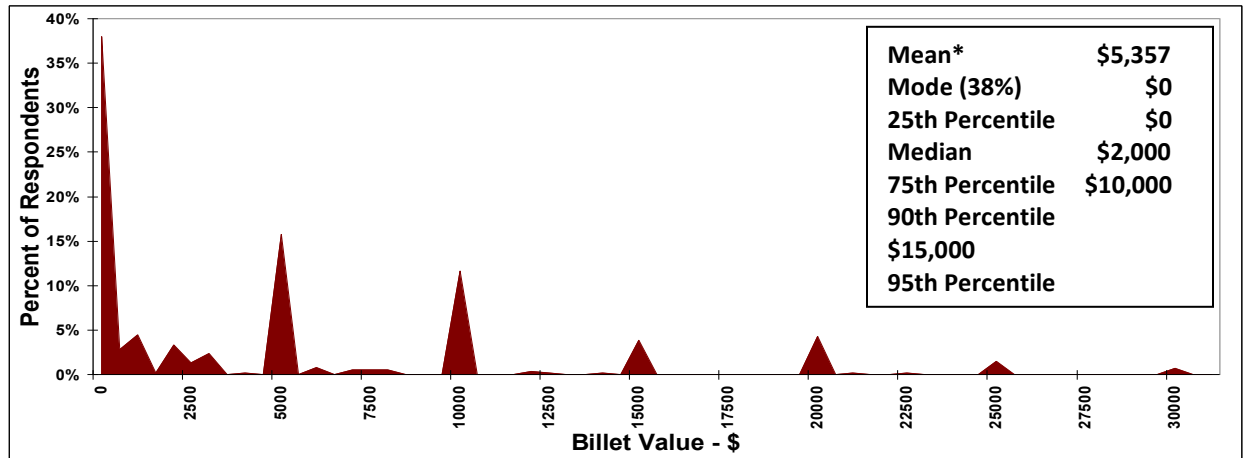


Figure 46. Enlisted Billet Value Distribution

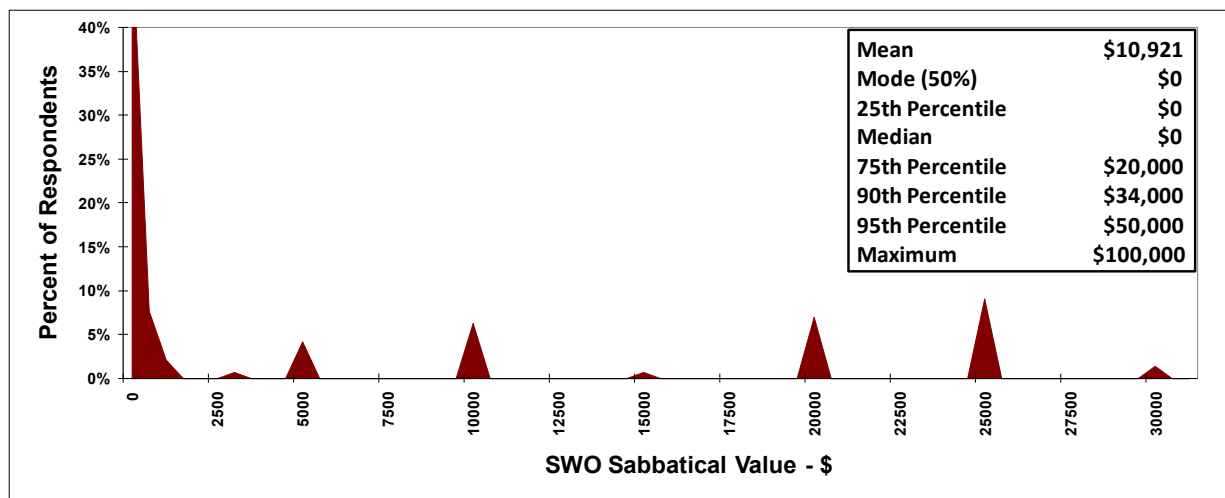


Figure 47. SWO Sabbatical Value Distribution

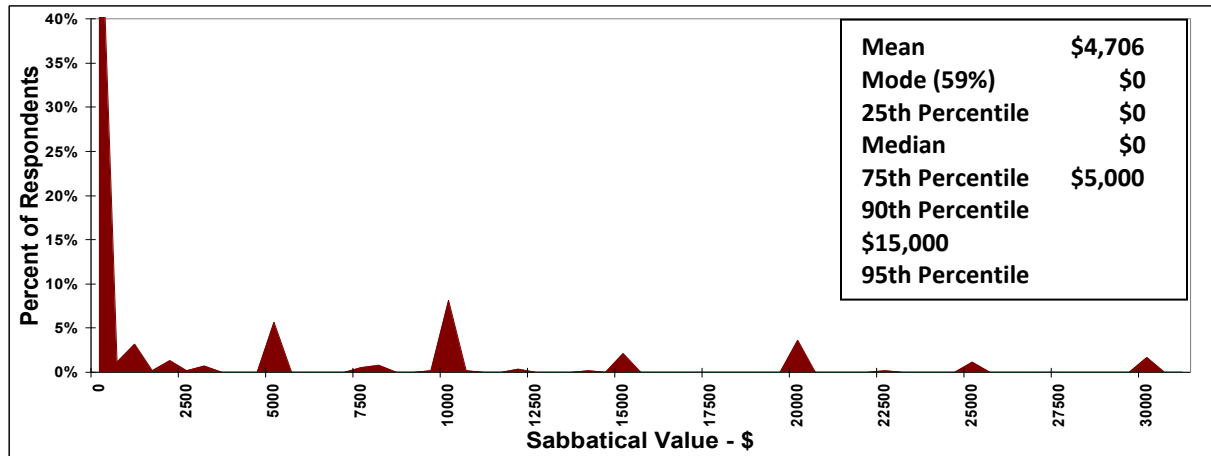


Figure 48. Enlisted Sabbatical Value Distribution

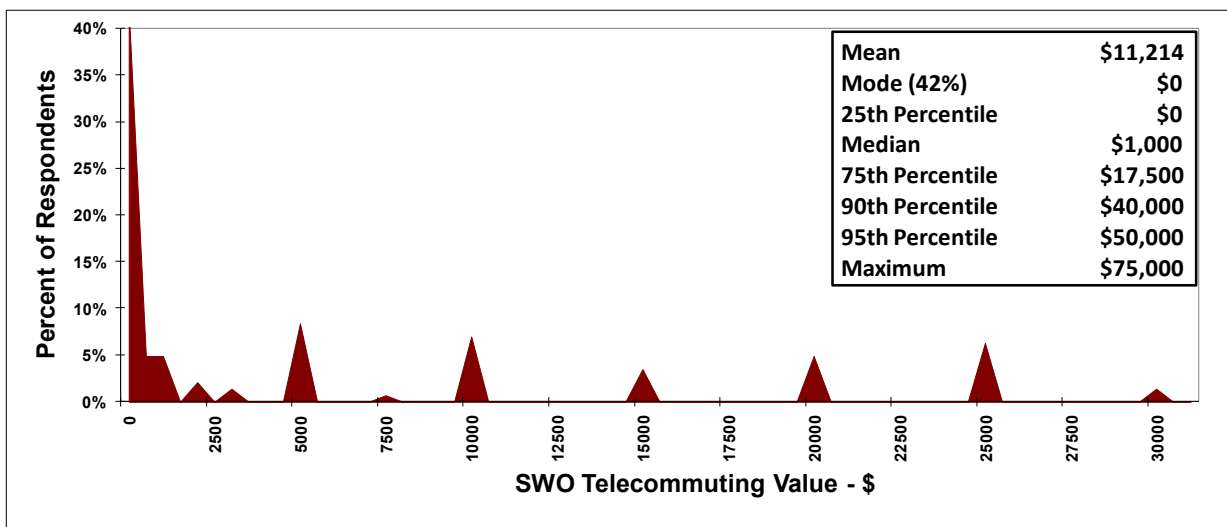


Figure 49. SWO Telecommuting Value Distribution

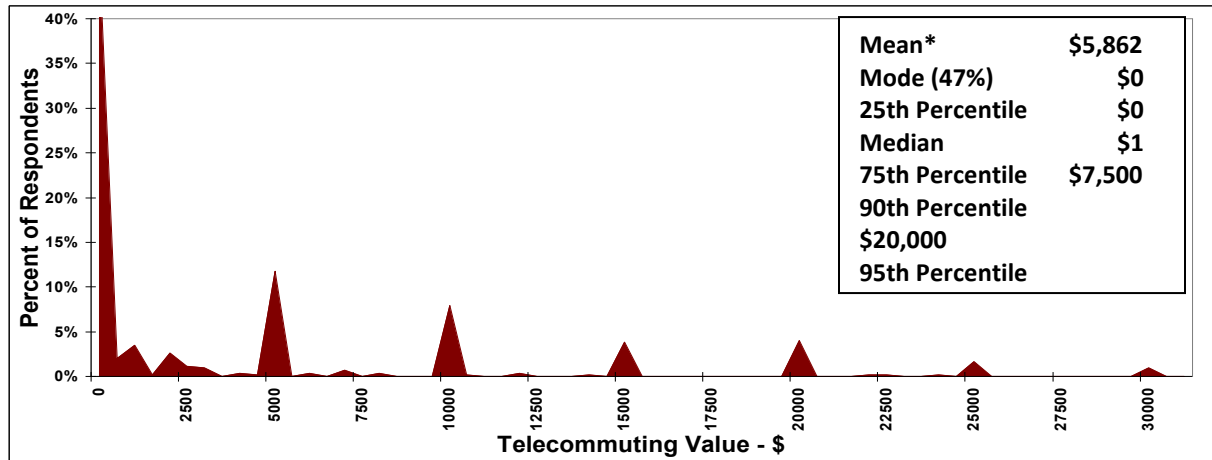


Figure 50. Enlisted Telecommuting Value Distribution

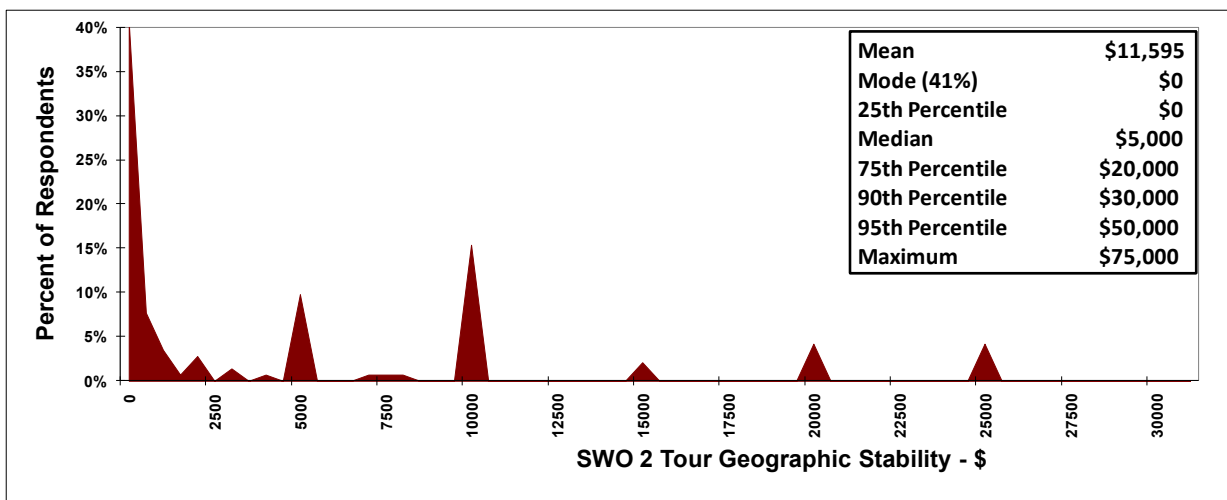


Figure 51. SWO Geographic Stability (2 Tours) Value Distribution

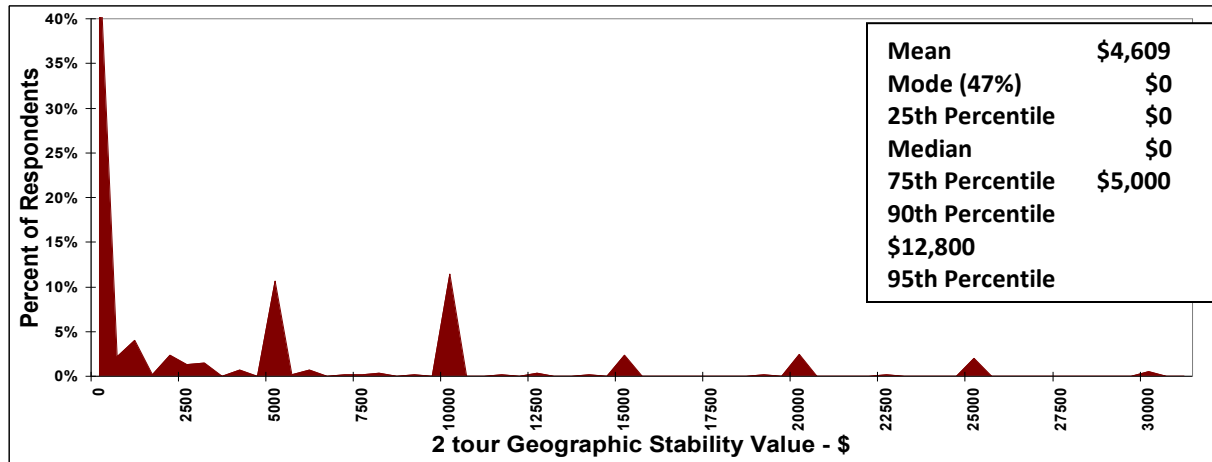


Figure 52. Enlisted Geographic Stability (2 Tours) Value Distribution

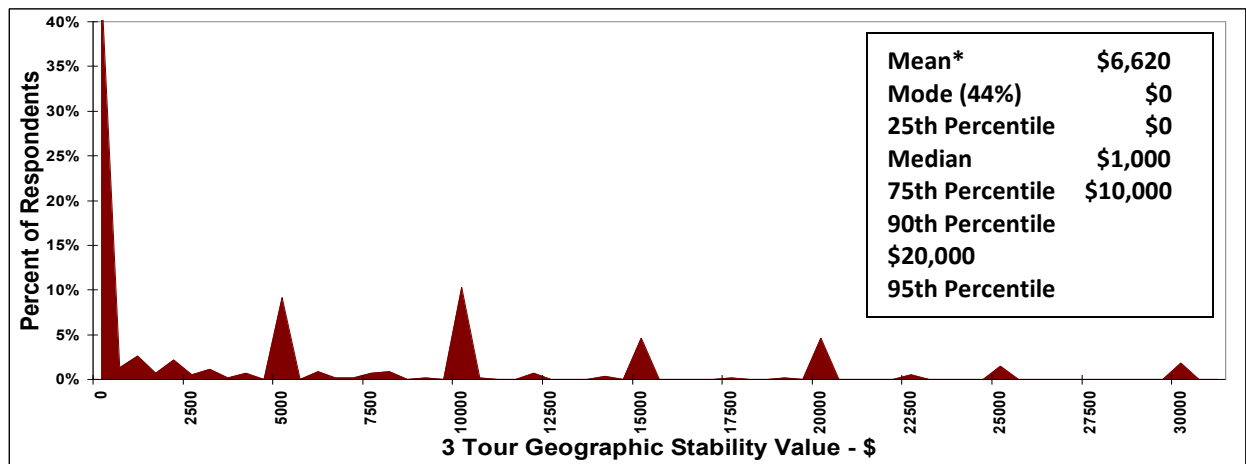


Figure 53. Enlisted Geographic Stability (3 Tours) Value Distribution

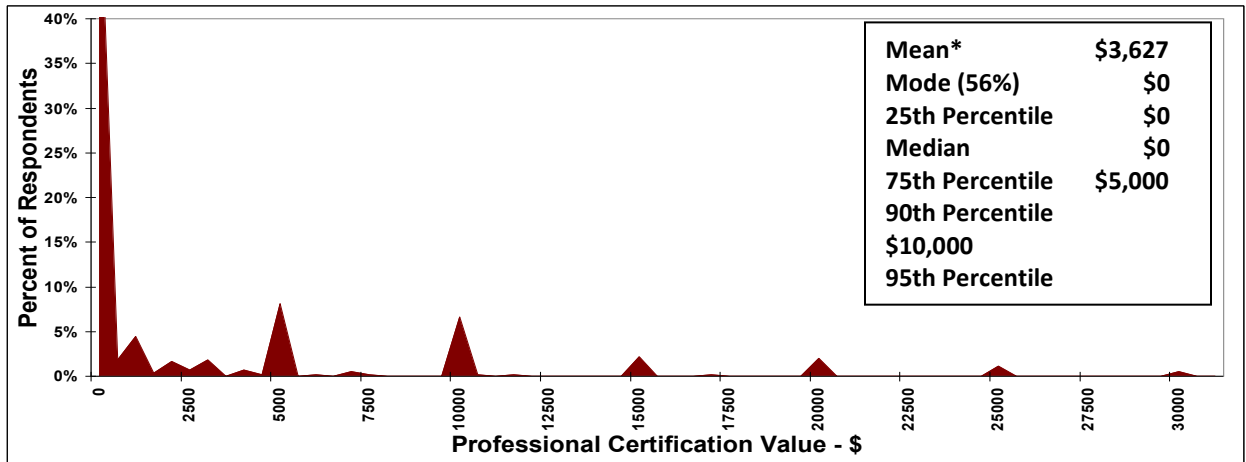


Figure 54. Enlisted Professional Certification Value Distribution

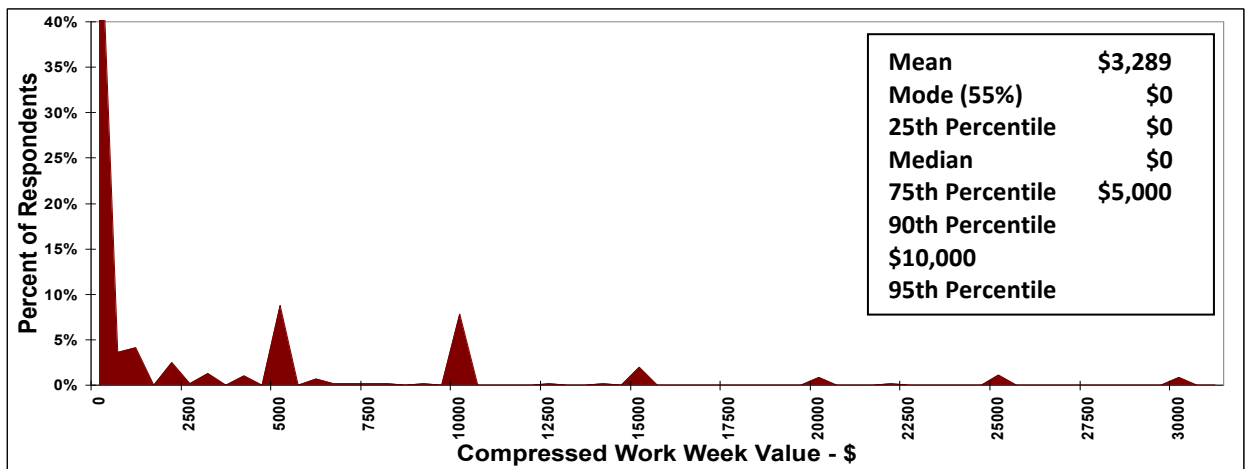


Figure 55. Enlisted Compressed Work Week Value Distribution

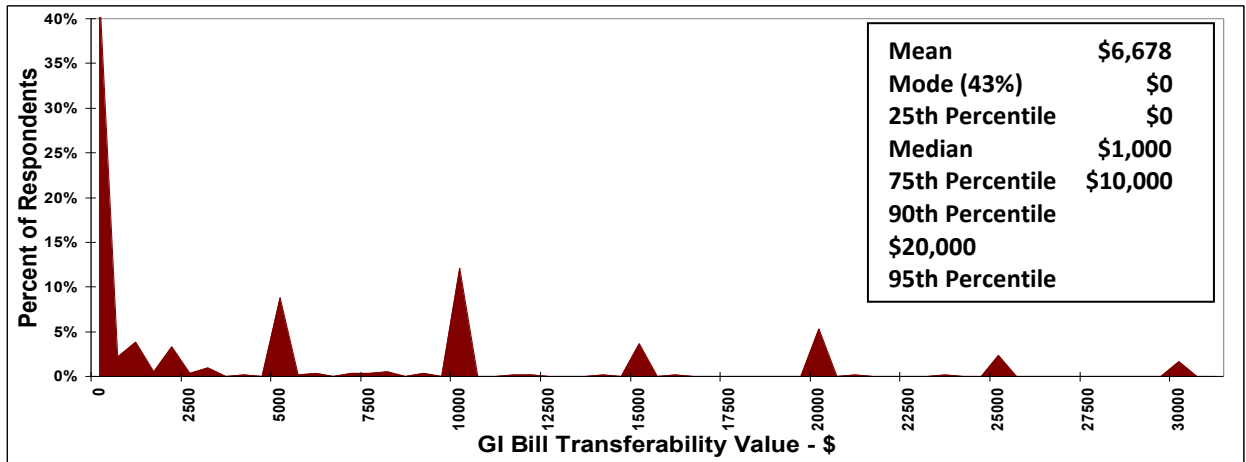


Figure 56. GI Bill Transferability Value Distribution

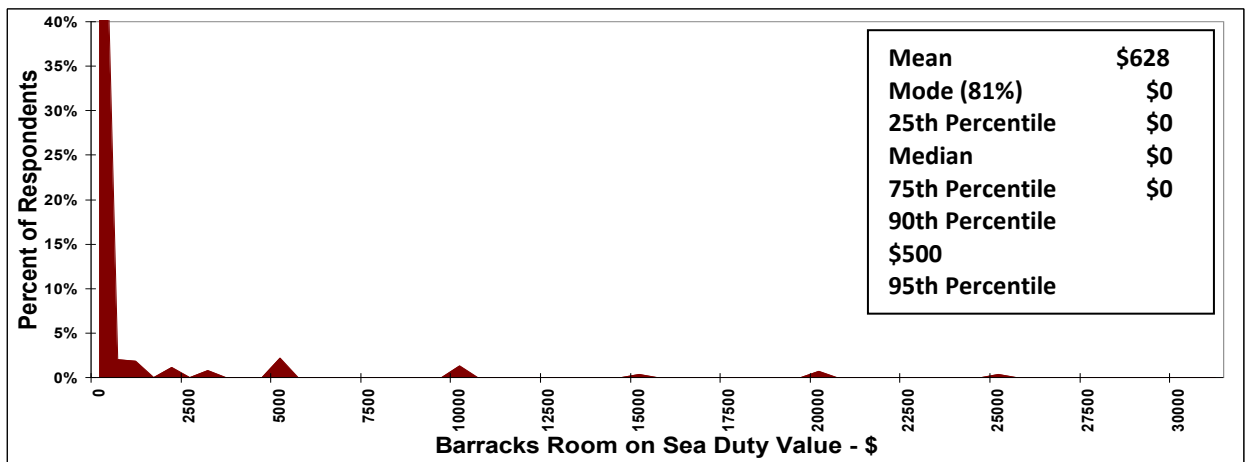


Figure 57. Enlisted Barracks Room on Sea Duty Value Distribution

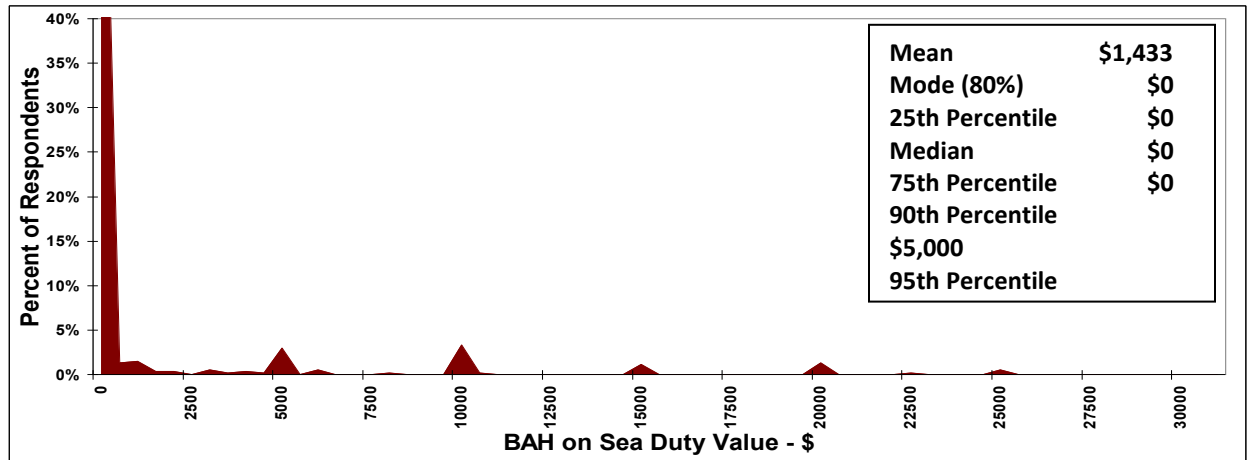


Figure 58. BAH on Sea Duty Value Distribution

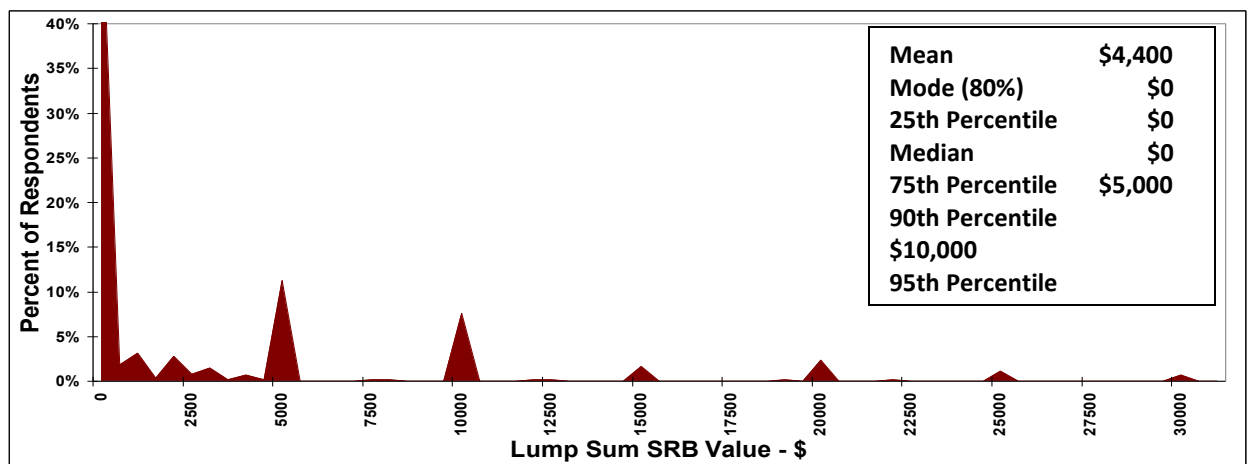


Figure 59. Lump Sum SRB Value Distribution

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Appendix D. SWO Survey: Varying Percentile (All Positive) Cost Simulation Results

A. 25% Retention

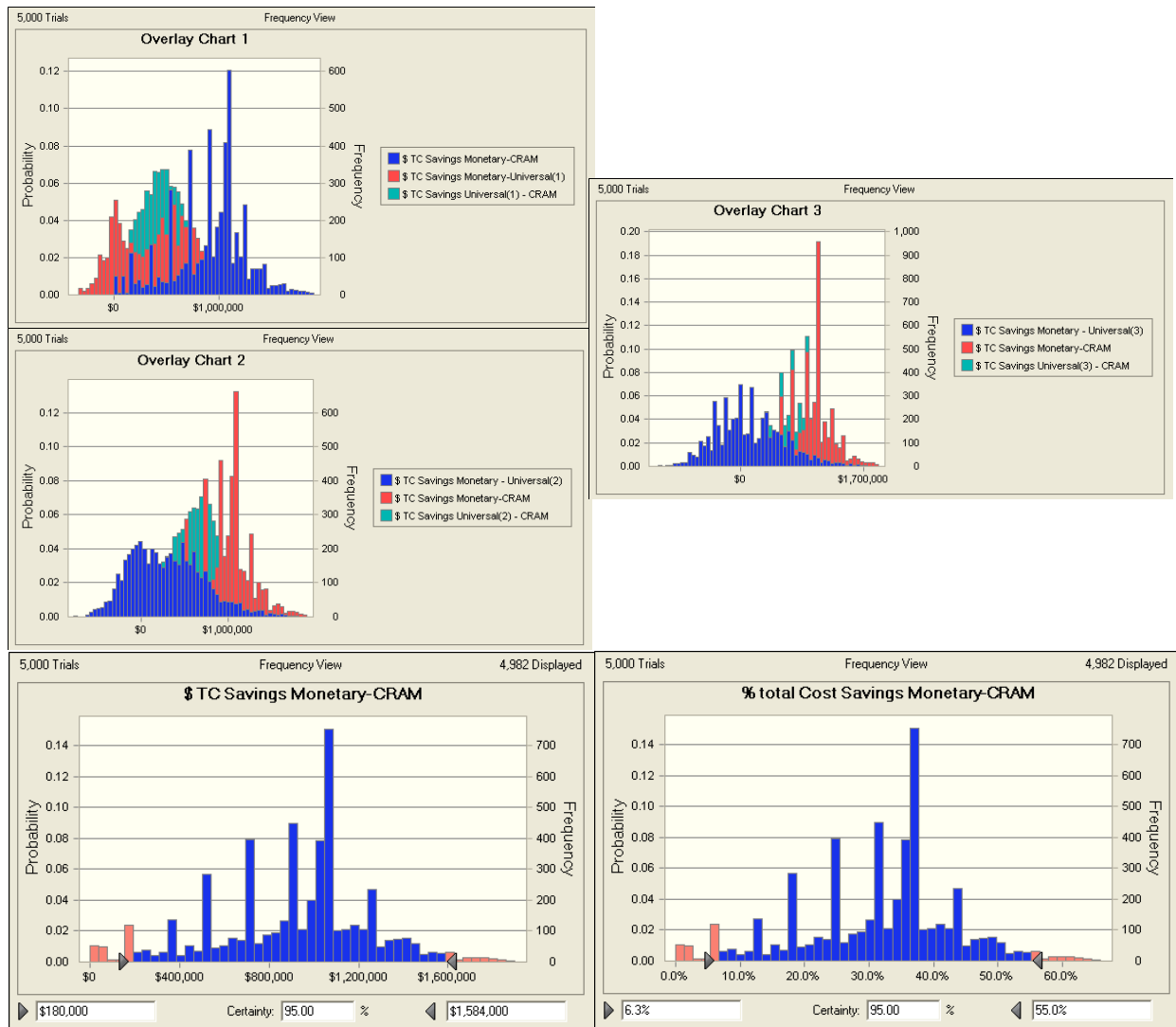


Figure 60. Overlay Charts and CRAM Savings over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

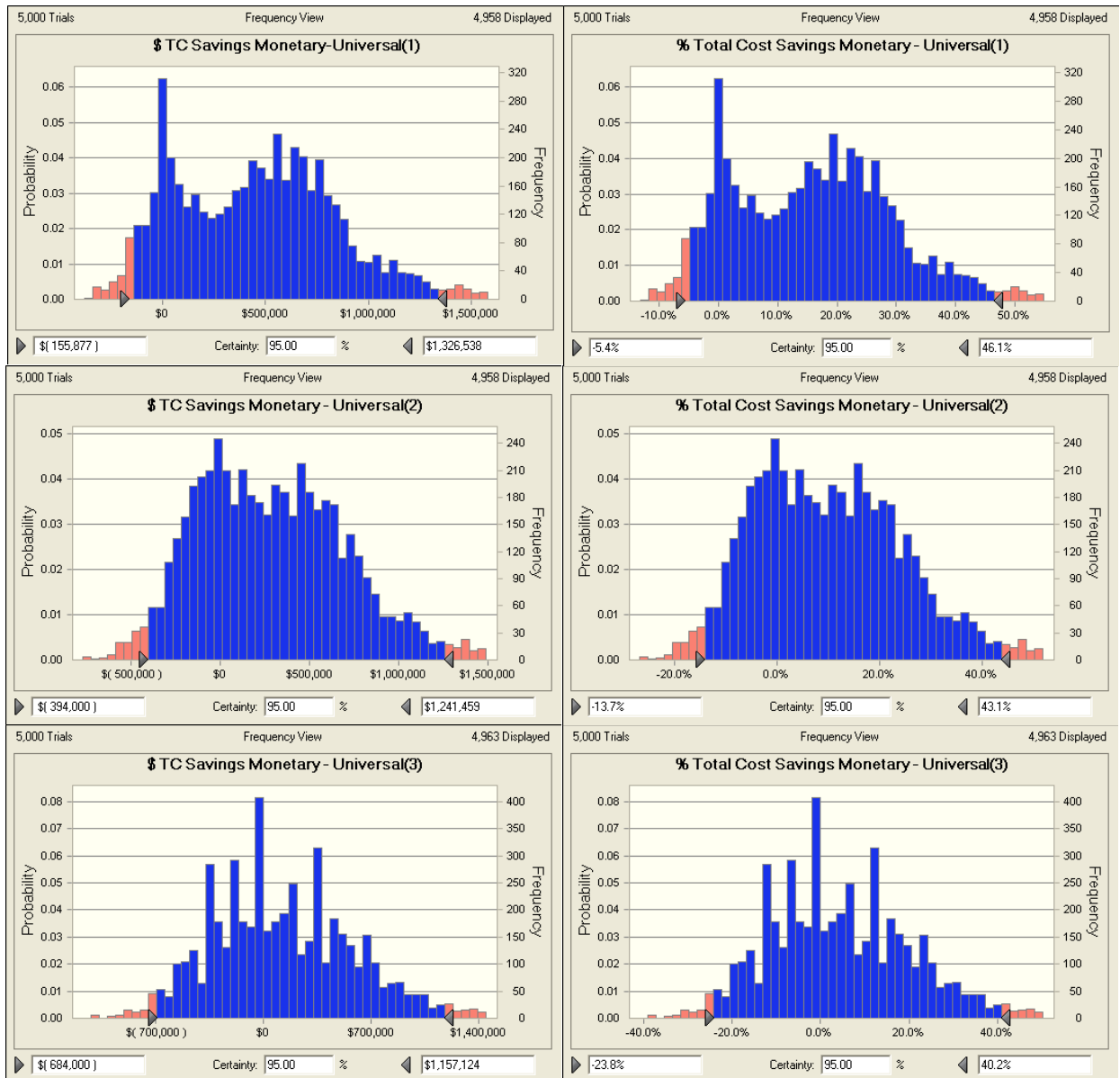


Figure 61. UIP Savings/Costs over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

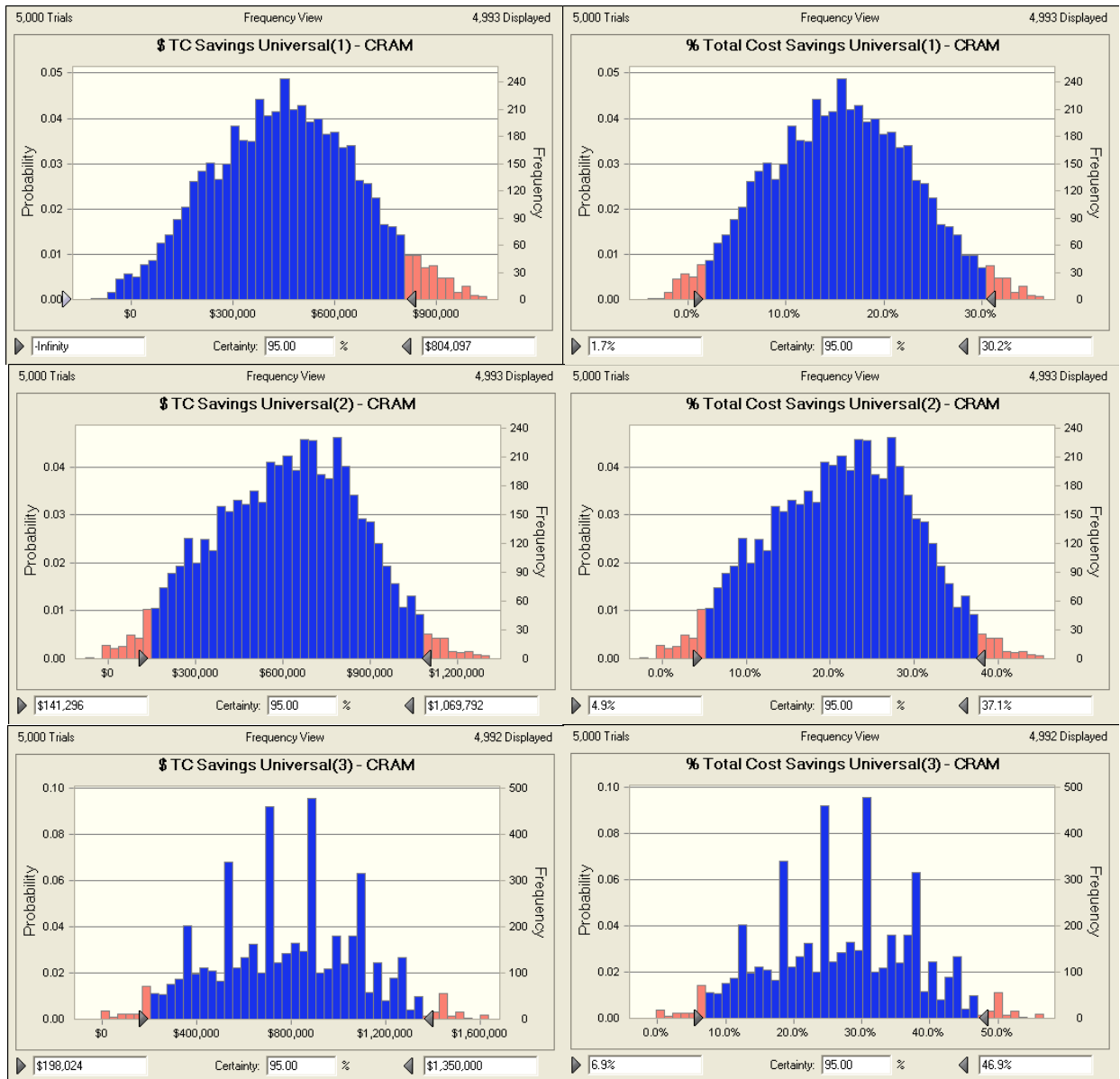


Figure 62. CRAM Savings over UIP
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

B. 50% Retention

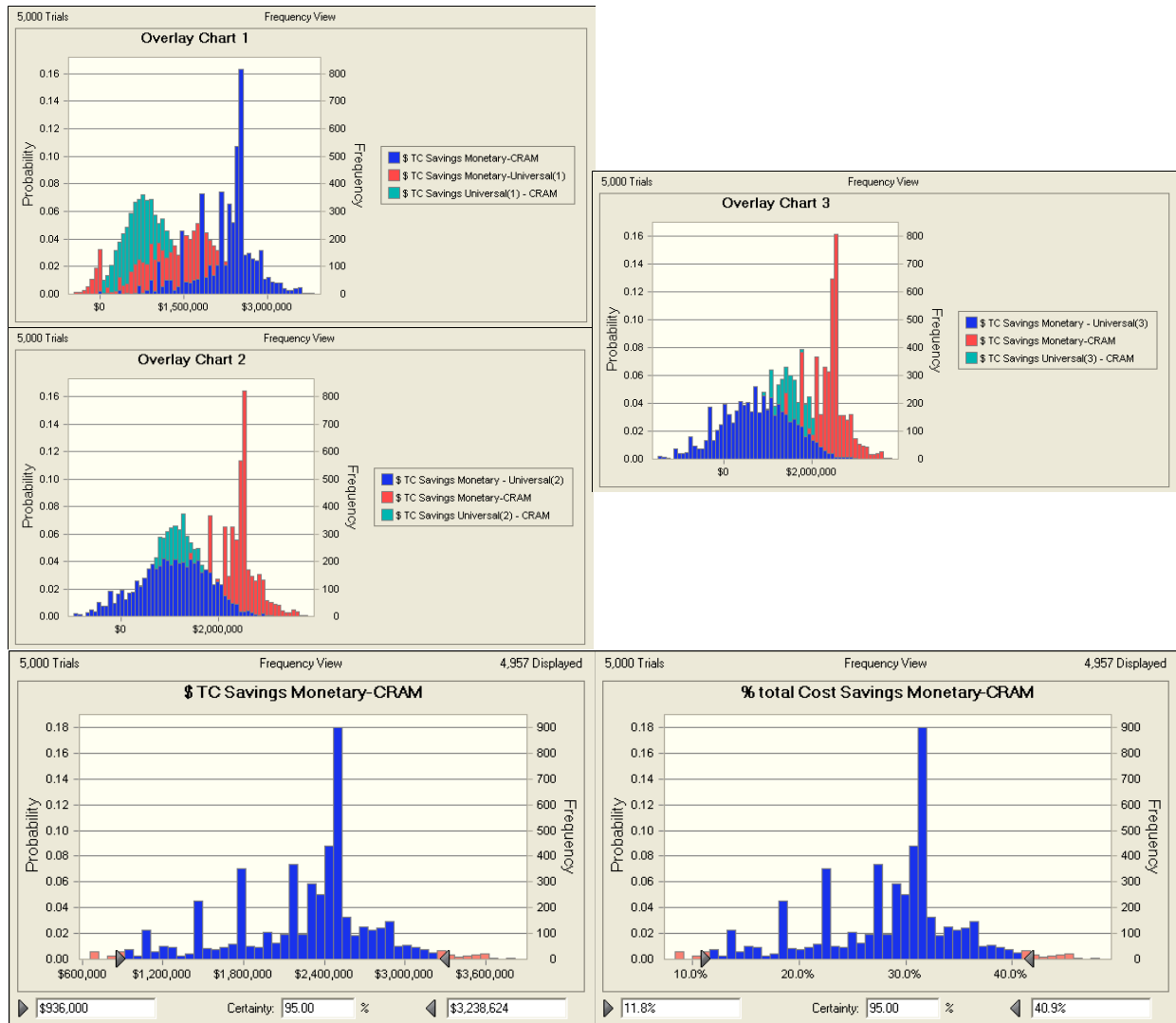


Figure 63. Overlay Charts and CRAM Savings over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

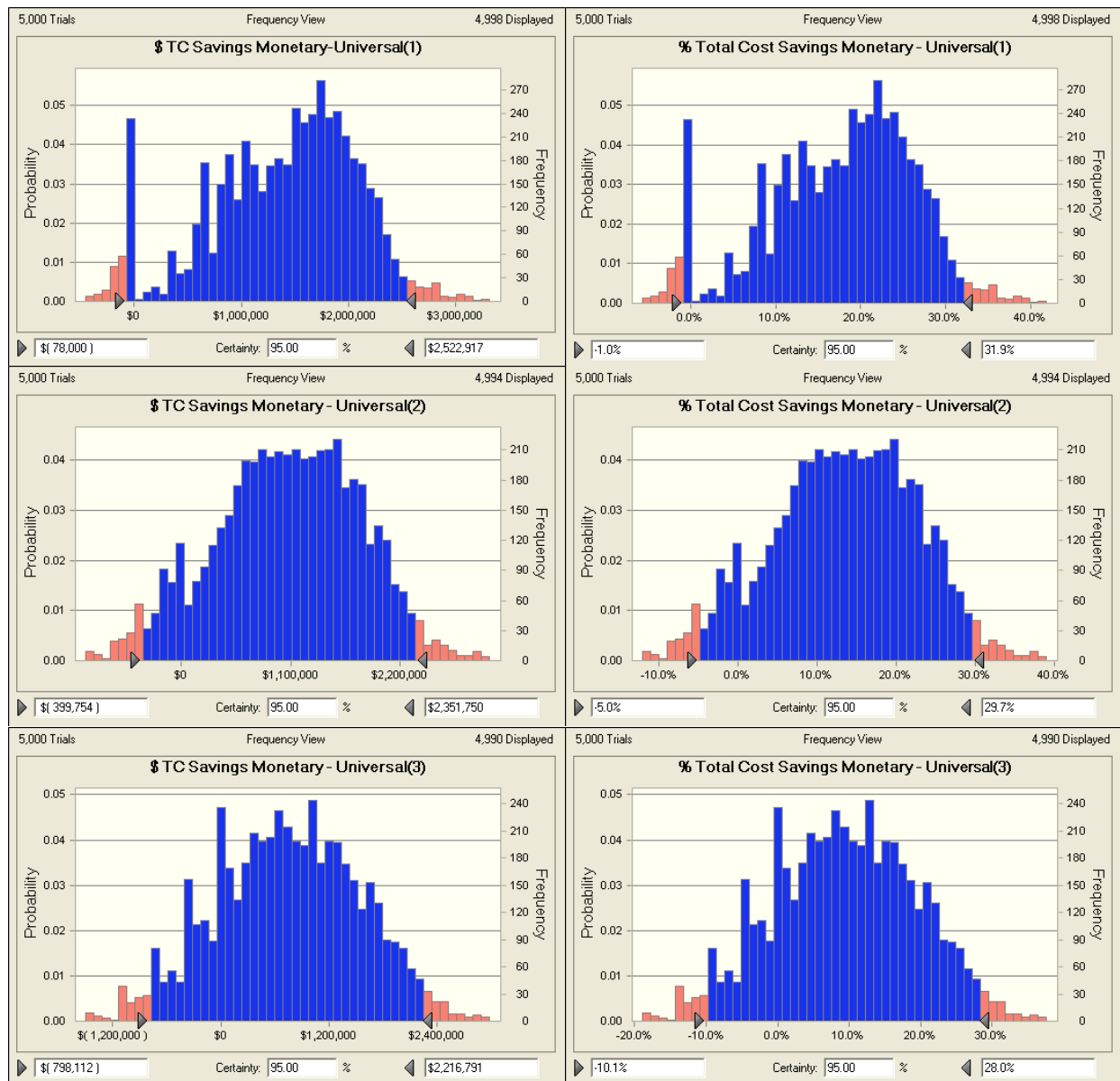


Figure 64. UIP Savings/Costs over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

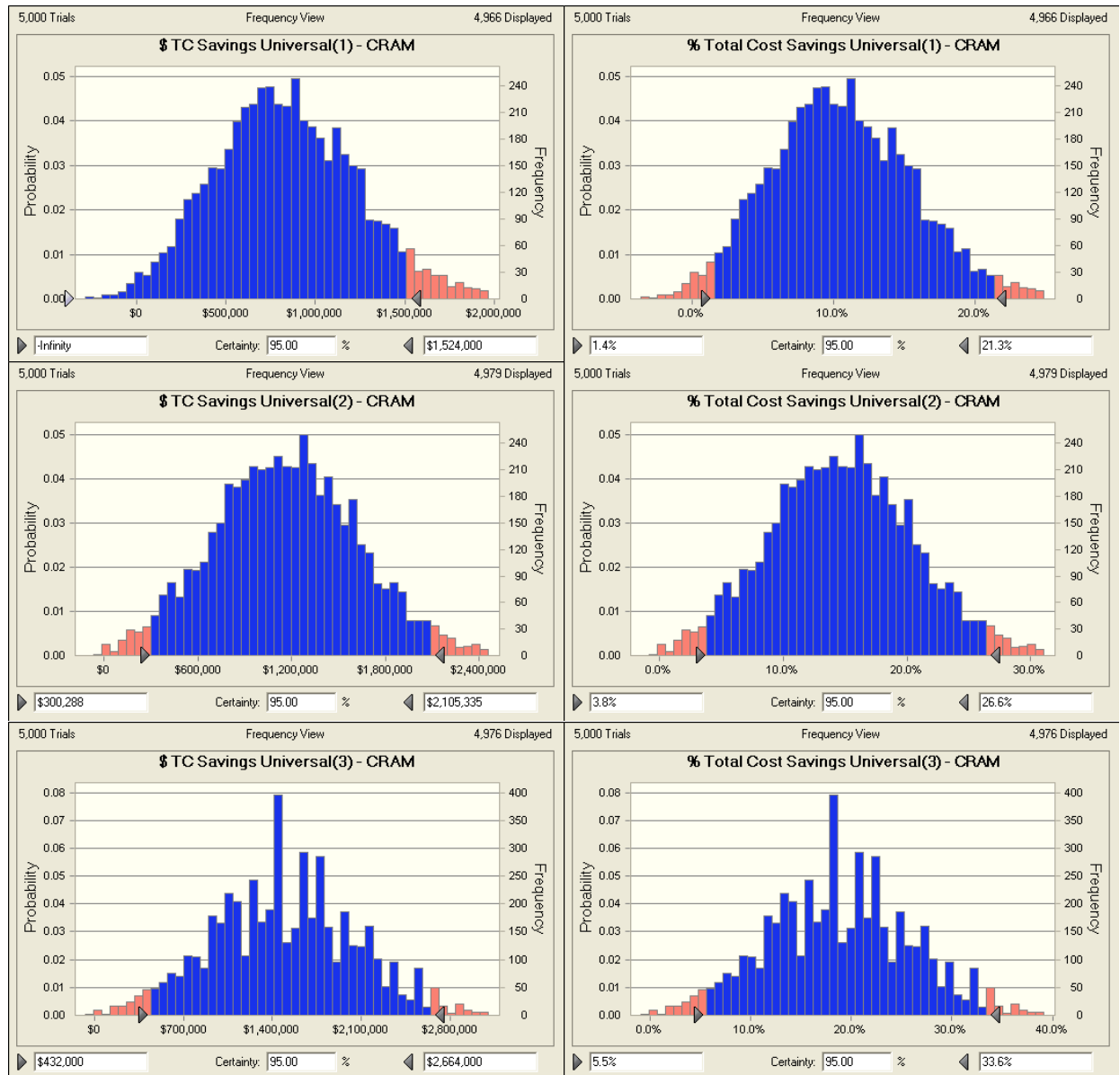


Figure 65. CRAM Savings over UIP
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

C. 75% Retention



Figure 66. Overlay Charts and CRAM Savings over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

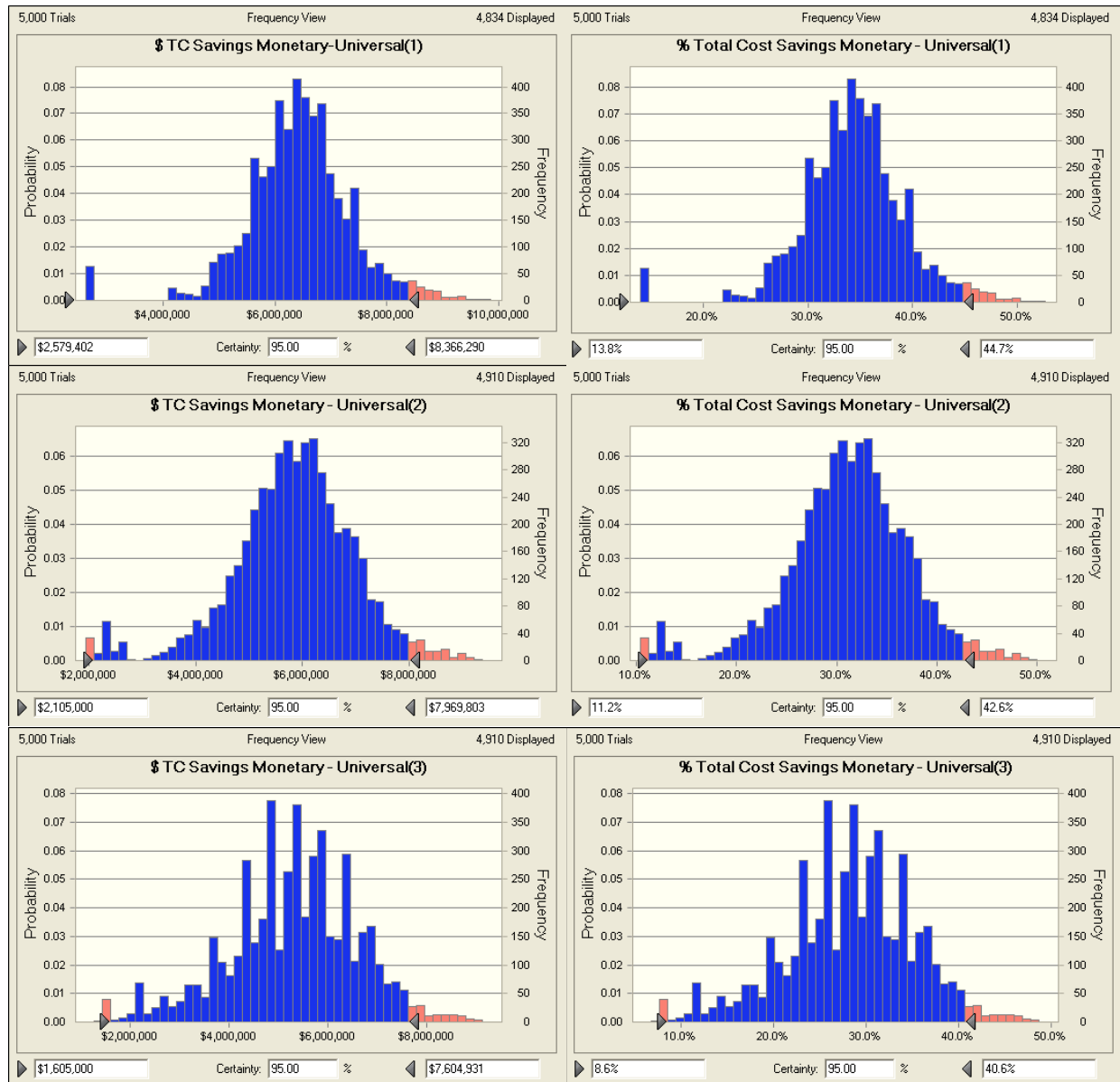


Figure 67. UIP Savings/Costs over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

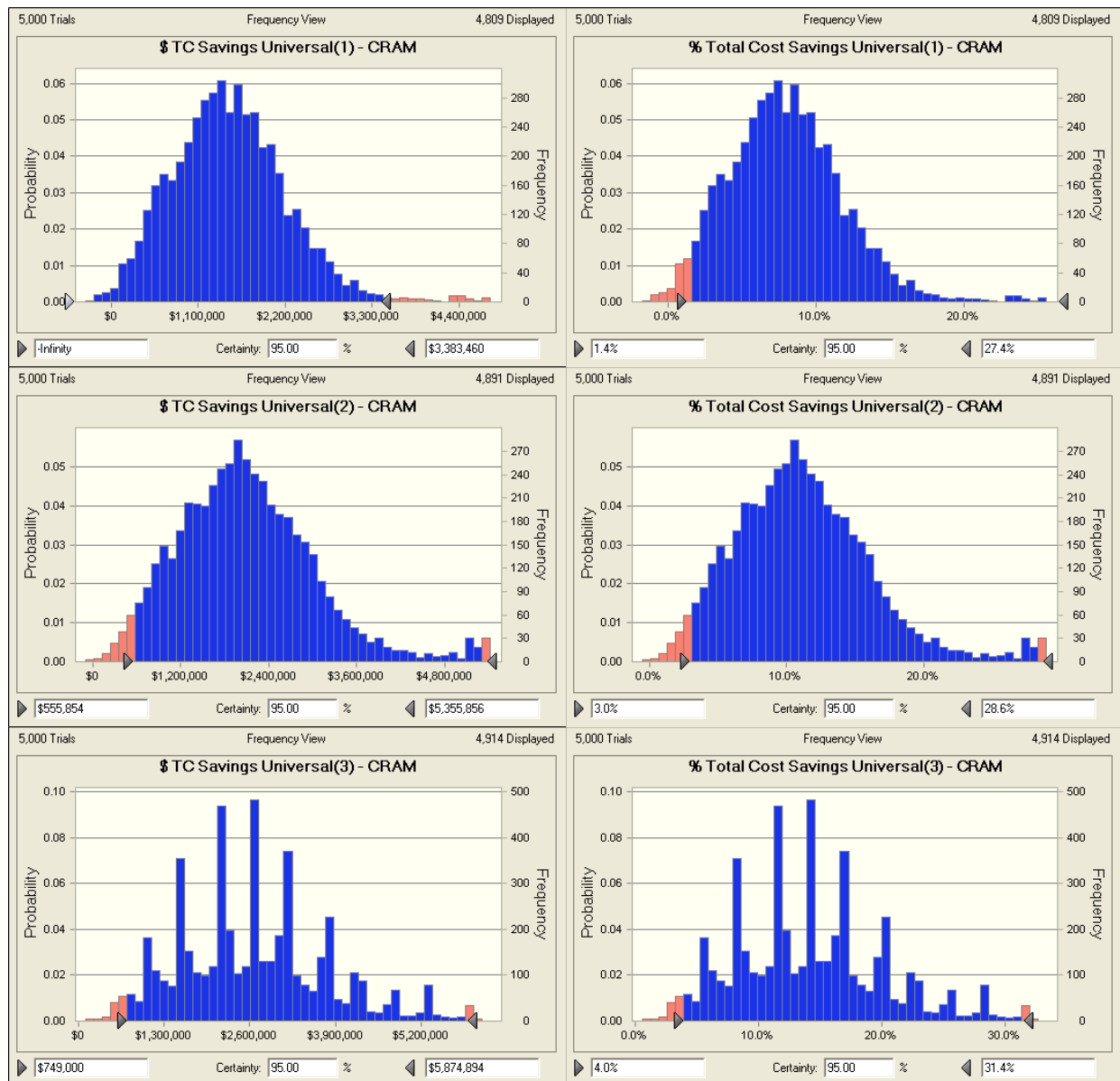


Figure 68. CRAM Savings over UIP
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

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Appendix E. Enlisted Survey: Varying Percentile (All Positive) Cost Simulation Results

A. 25% Retention

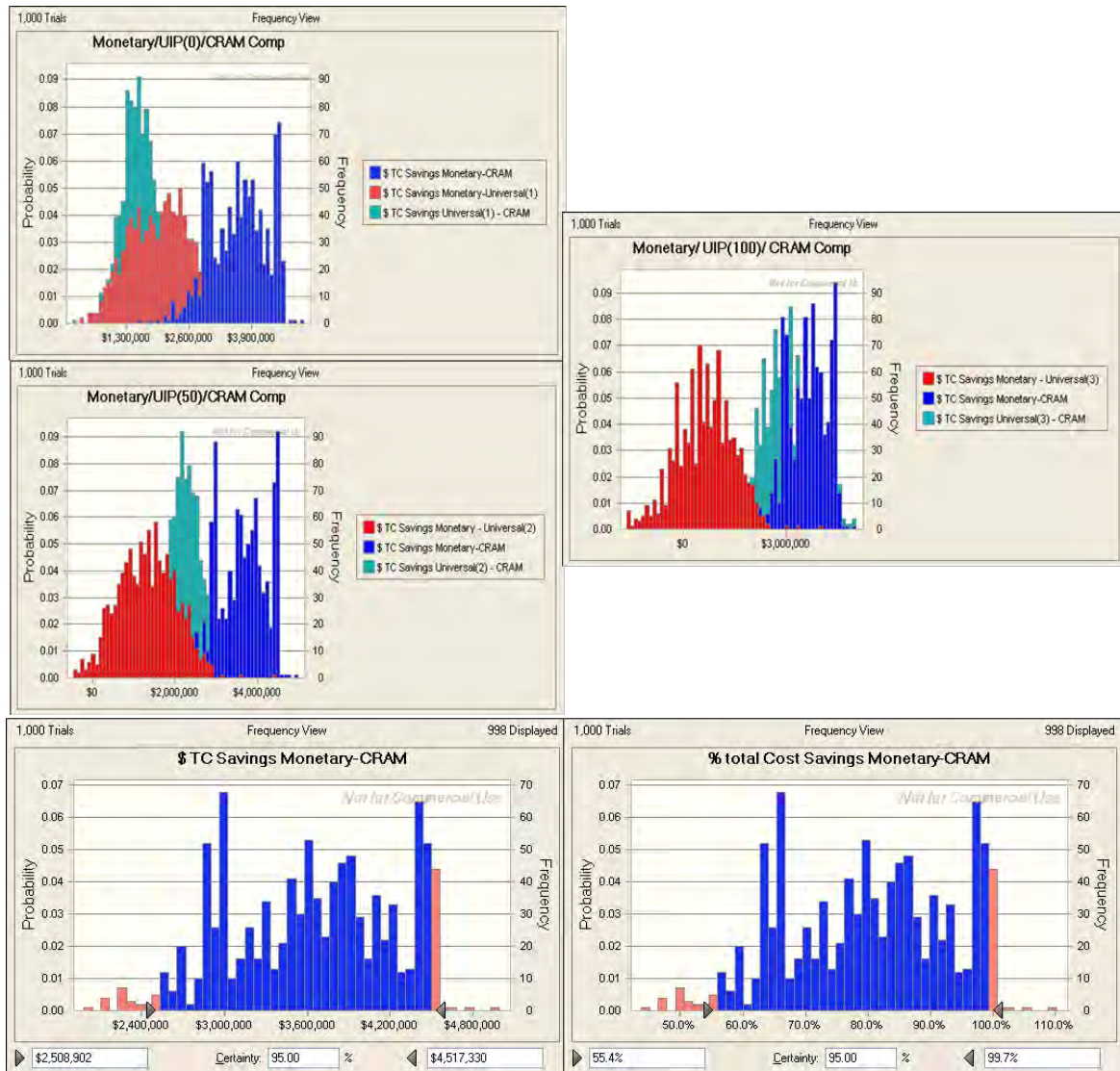


Figure 69. Overlay Charts and CRAM Savings over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

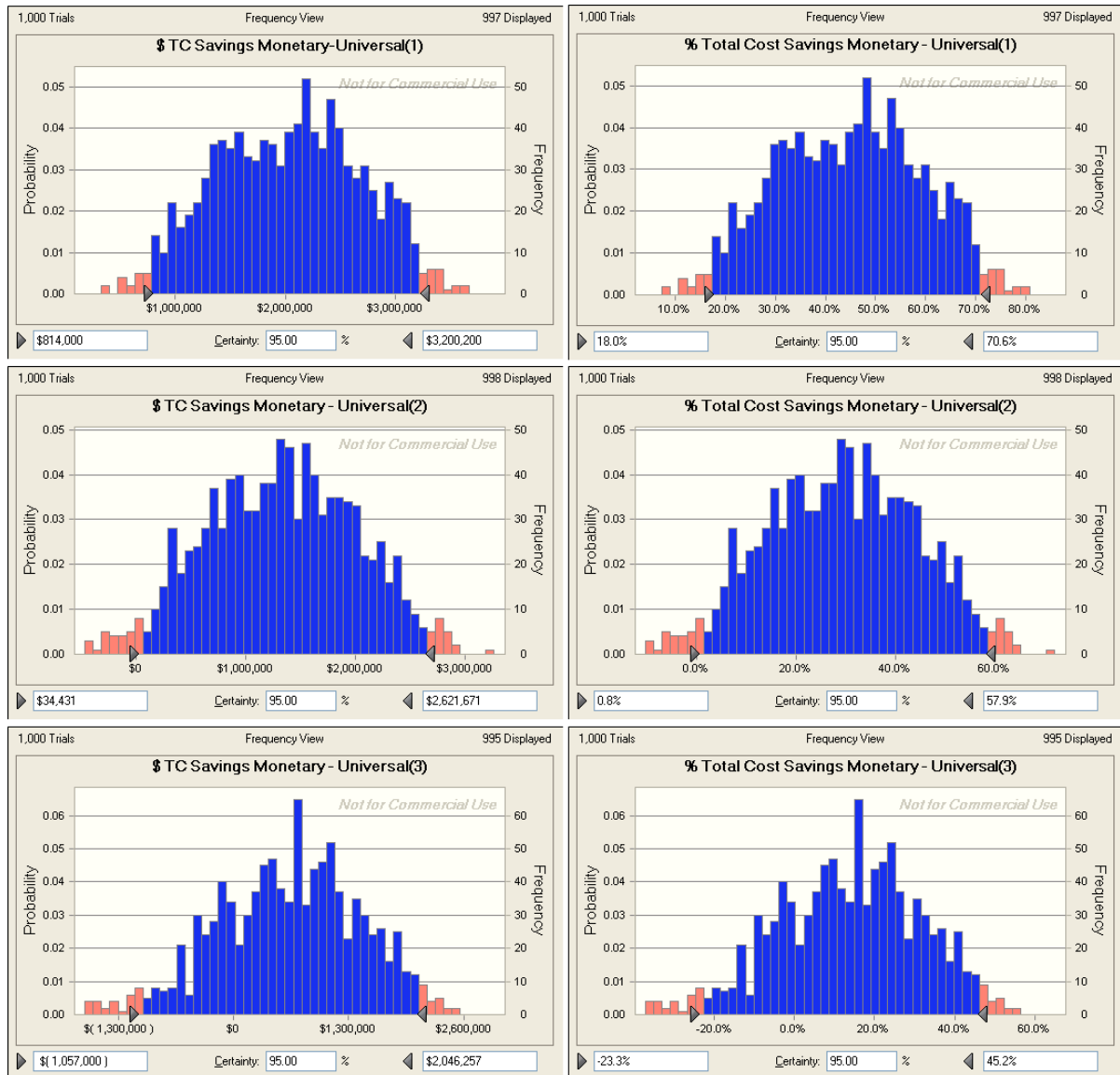


Figure 70. UIP Savings/Costs over Monetary
 Universal(1)=UIP(0);Universal(2)=UIP(50);Universal(3)=UIP(100)

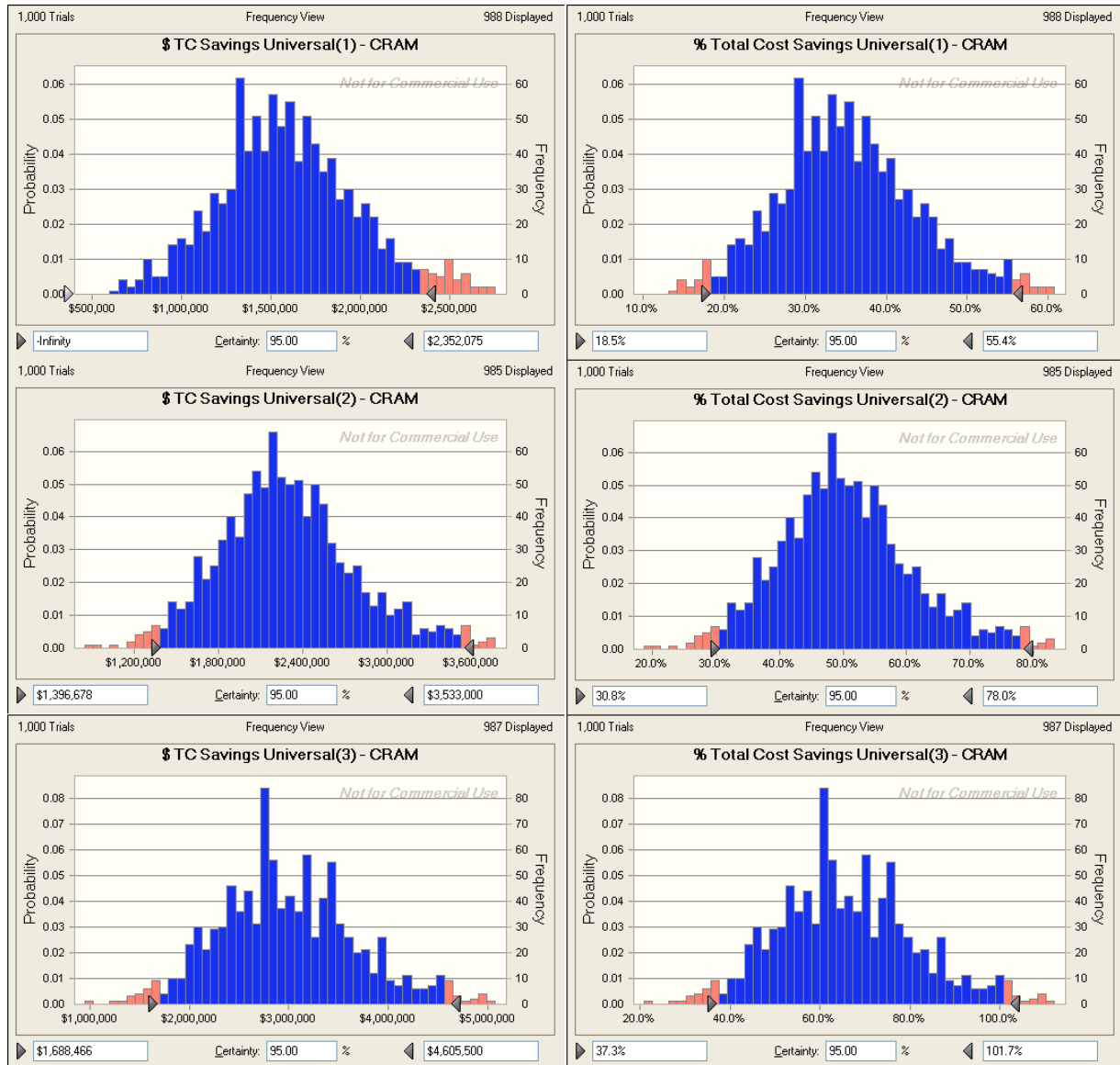


Figure 71. CRAM Savings over UIP
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

B. 50% Retention

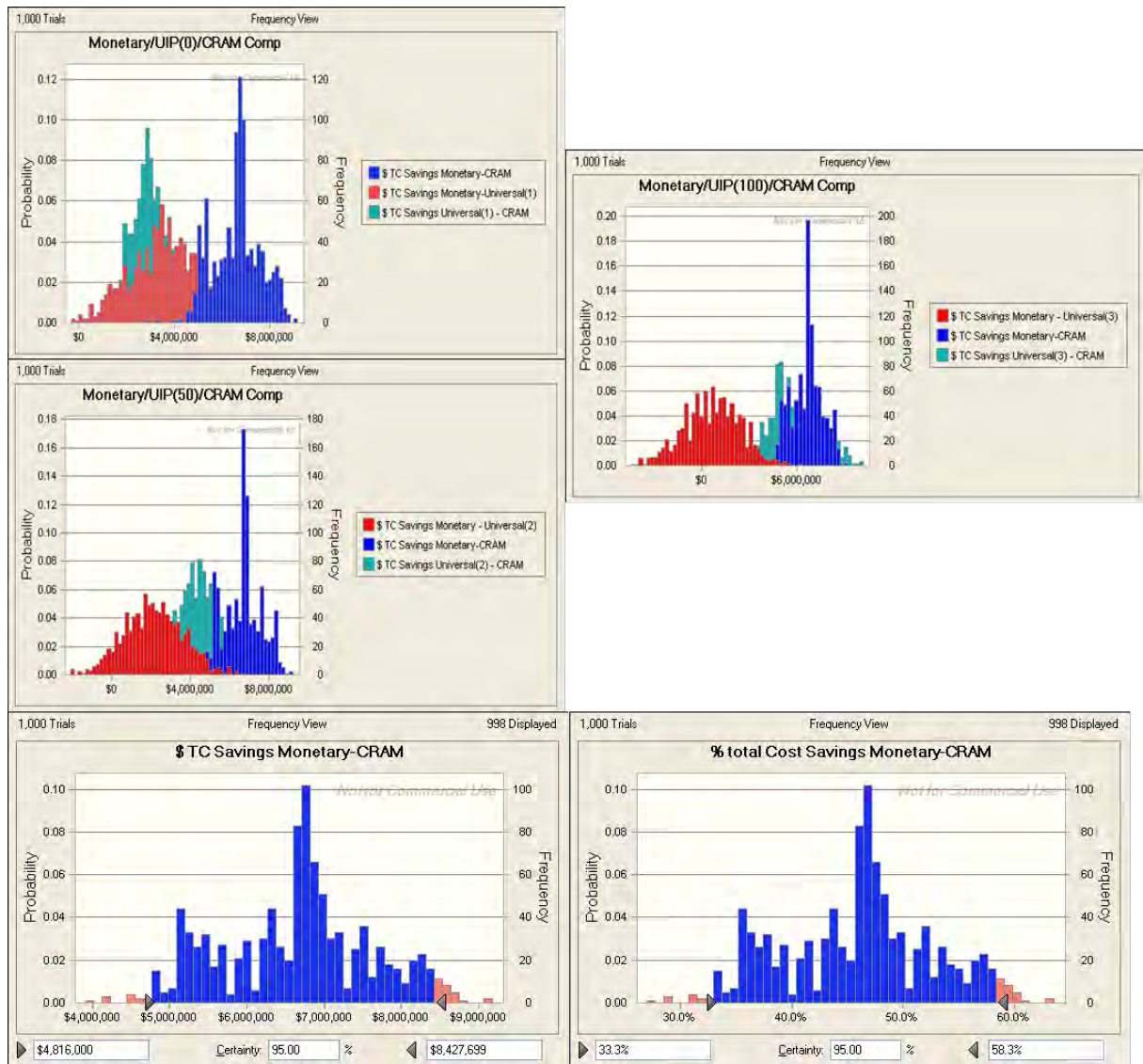


Figure 72. Overlay Charts and CRAM Savings over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

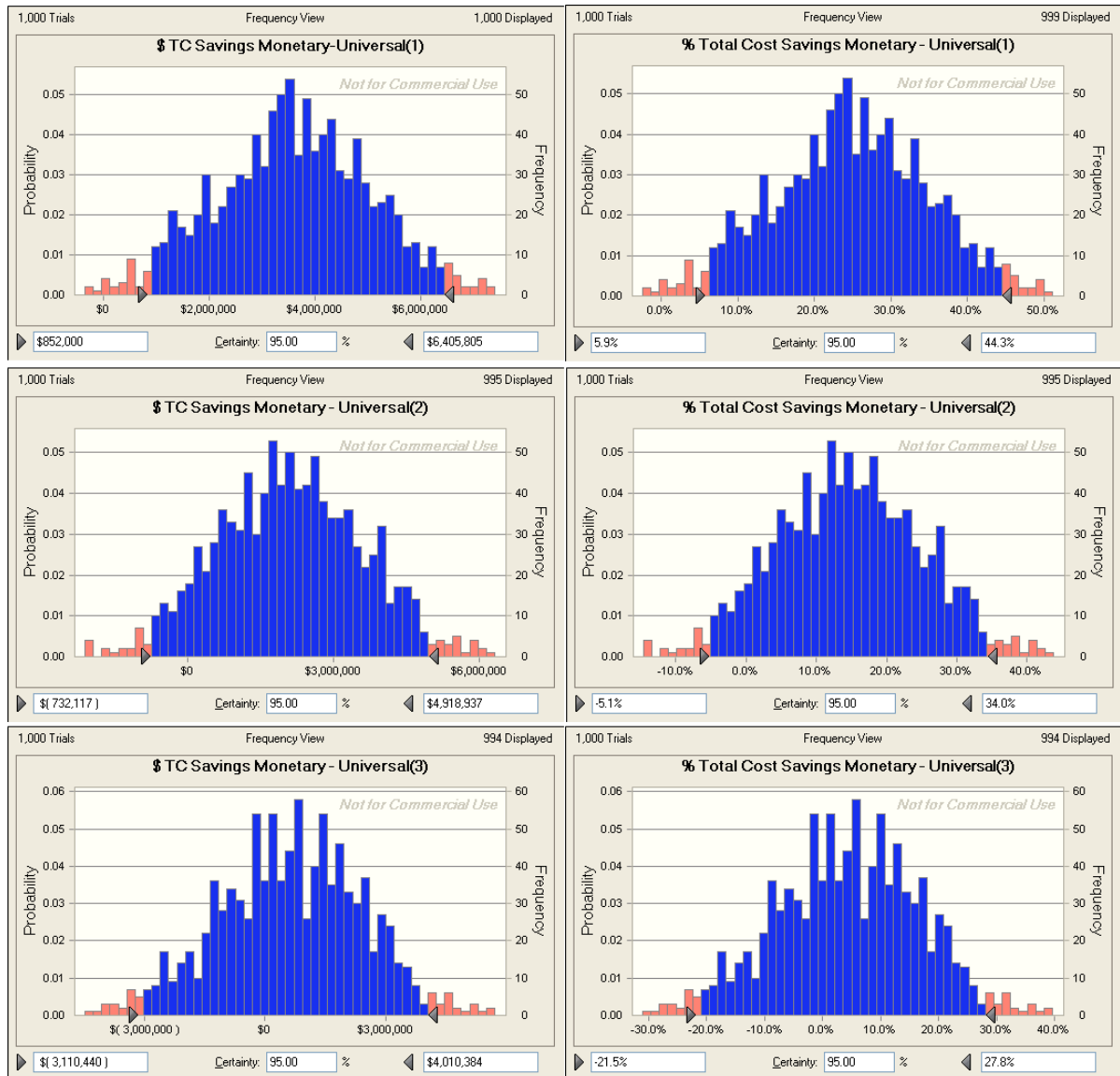


Figure 73. UIP Savings/Costs over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

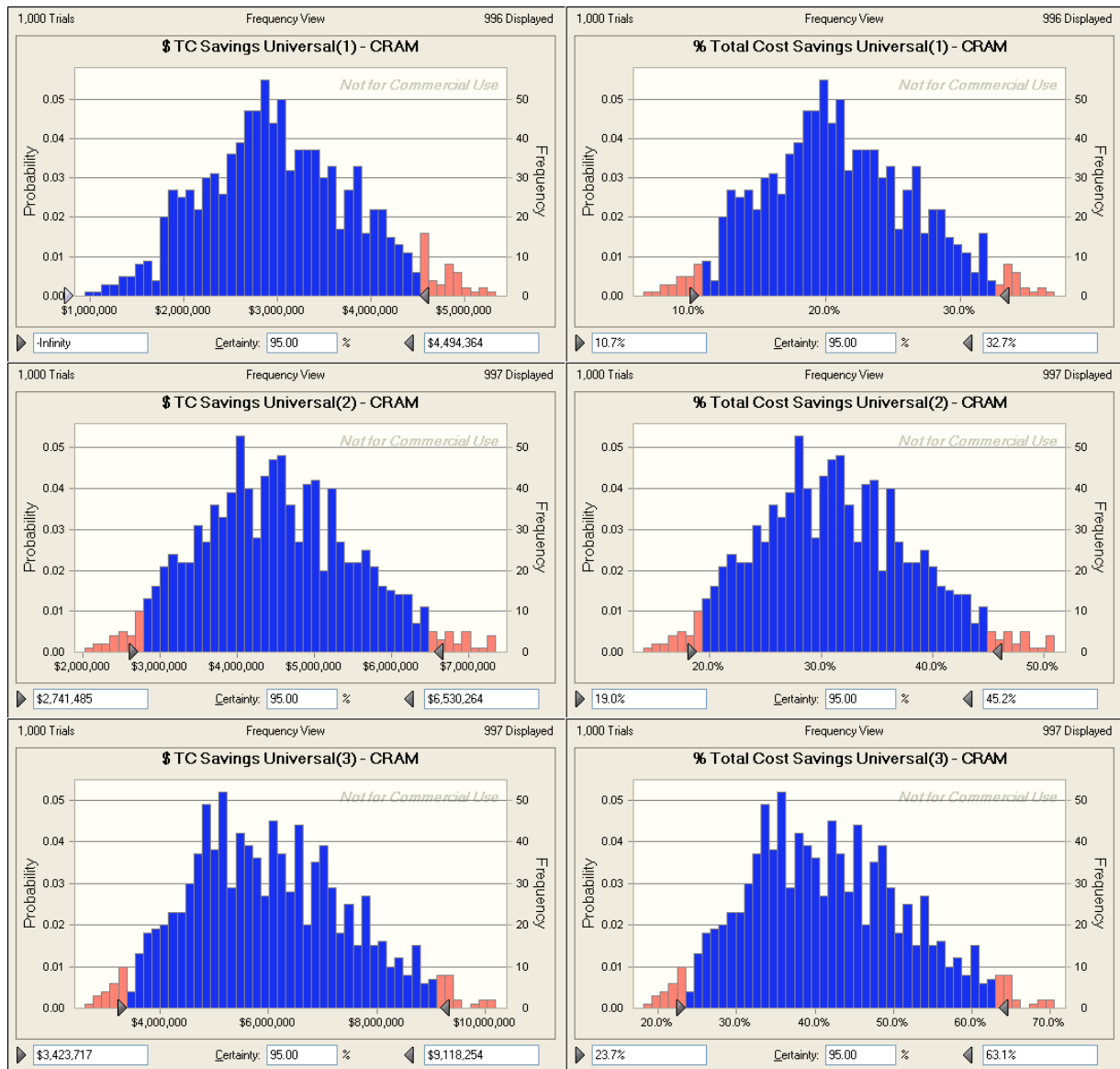


Figure 74. CRAM Savings over UIP
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

C. 75% Retention

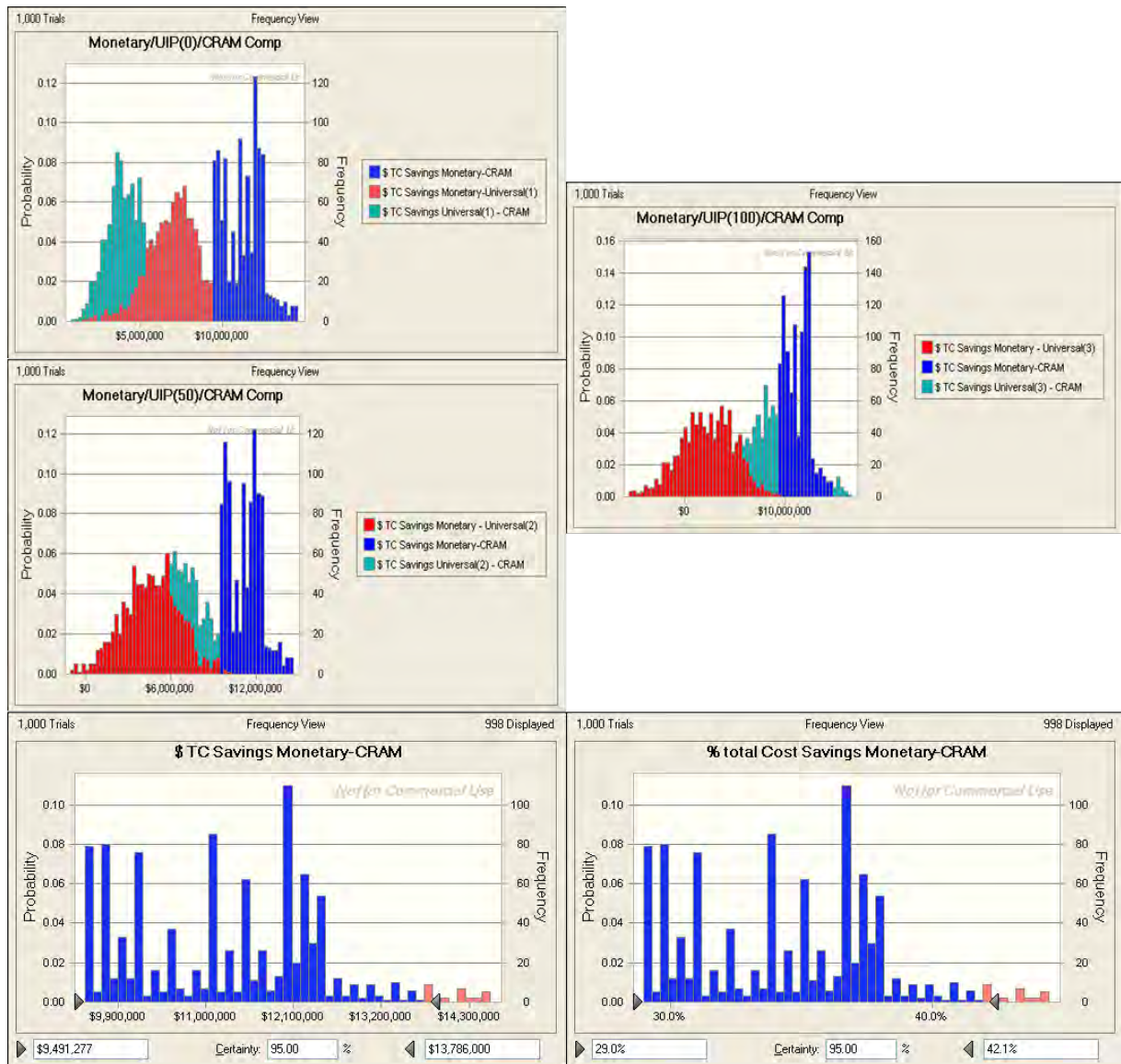
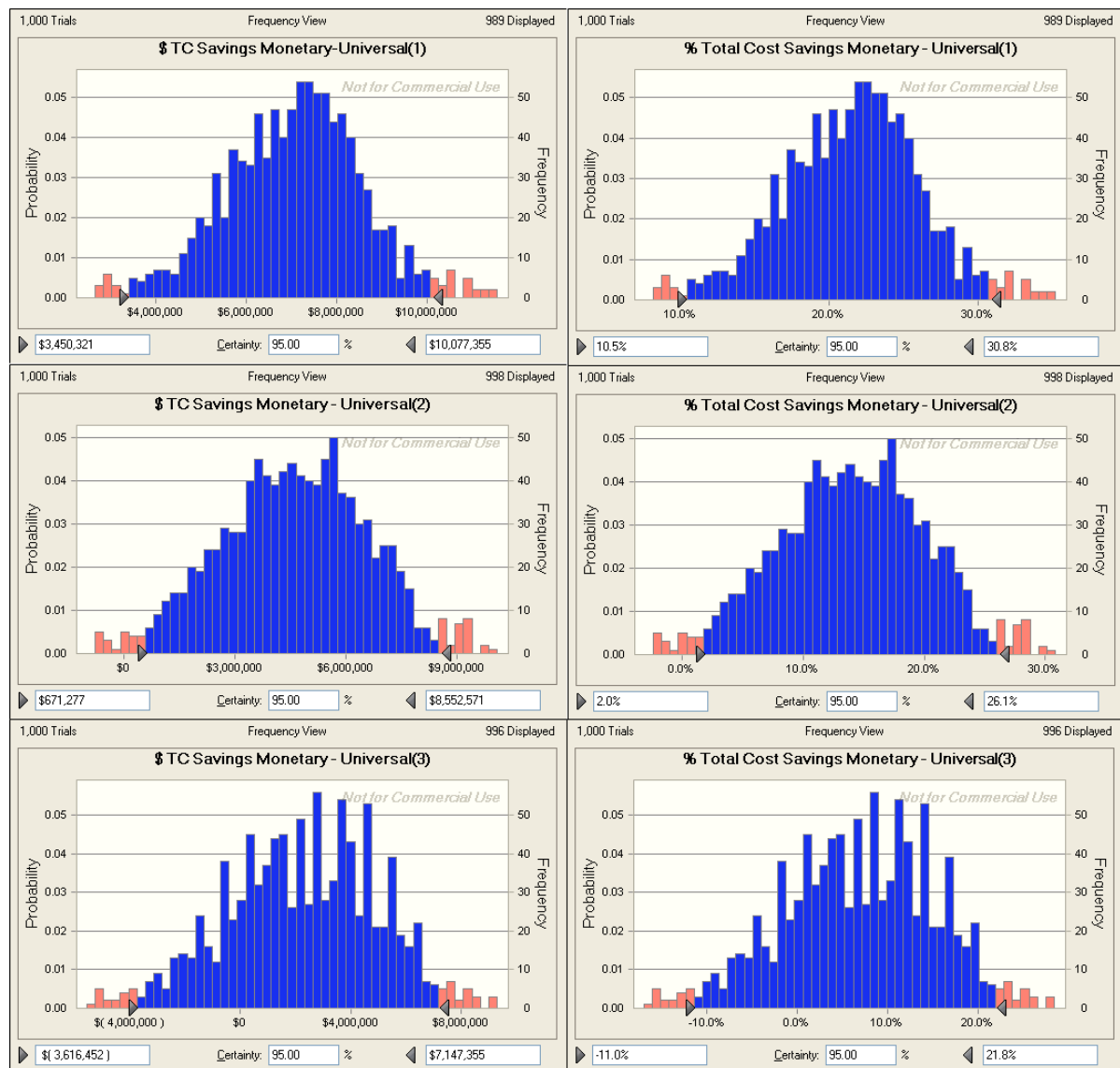


Figure 75. Overlay Charts and CRAM Savings over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)



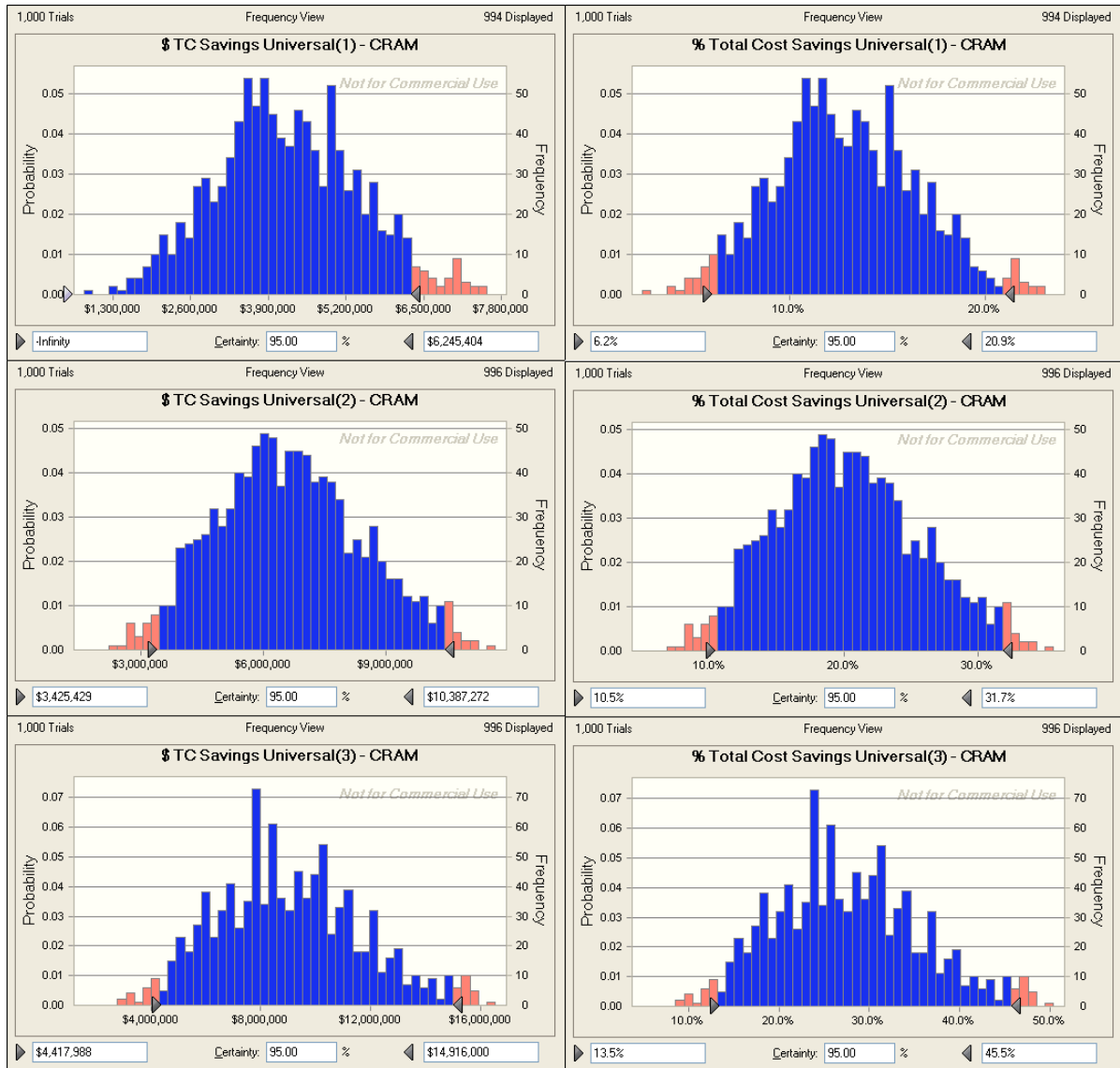


Figure 77. CRAM Savings over UIP
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

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Appendix F. Varying Percentile Cost (High Positive) Simulation Results

A. 25% Retention

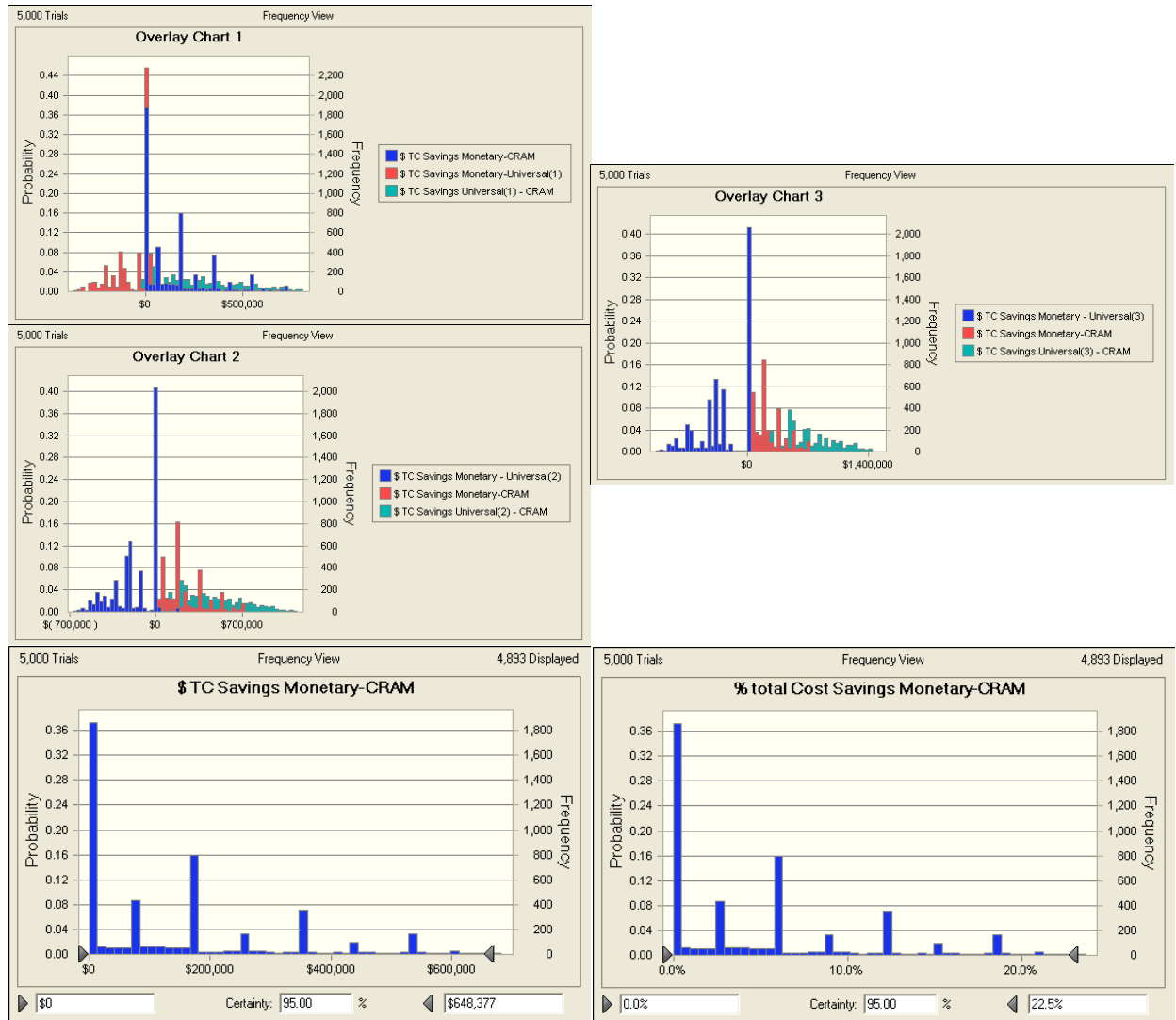


Figure 78. Overlay Charts and CRAM Savings over Monetary
 Universal(1)=UIP(0);Universal(2)=UIP(50);Universal(3)=UIP(100)

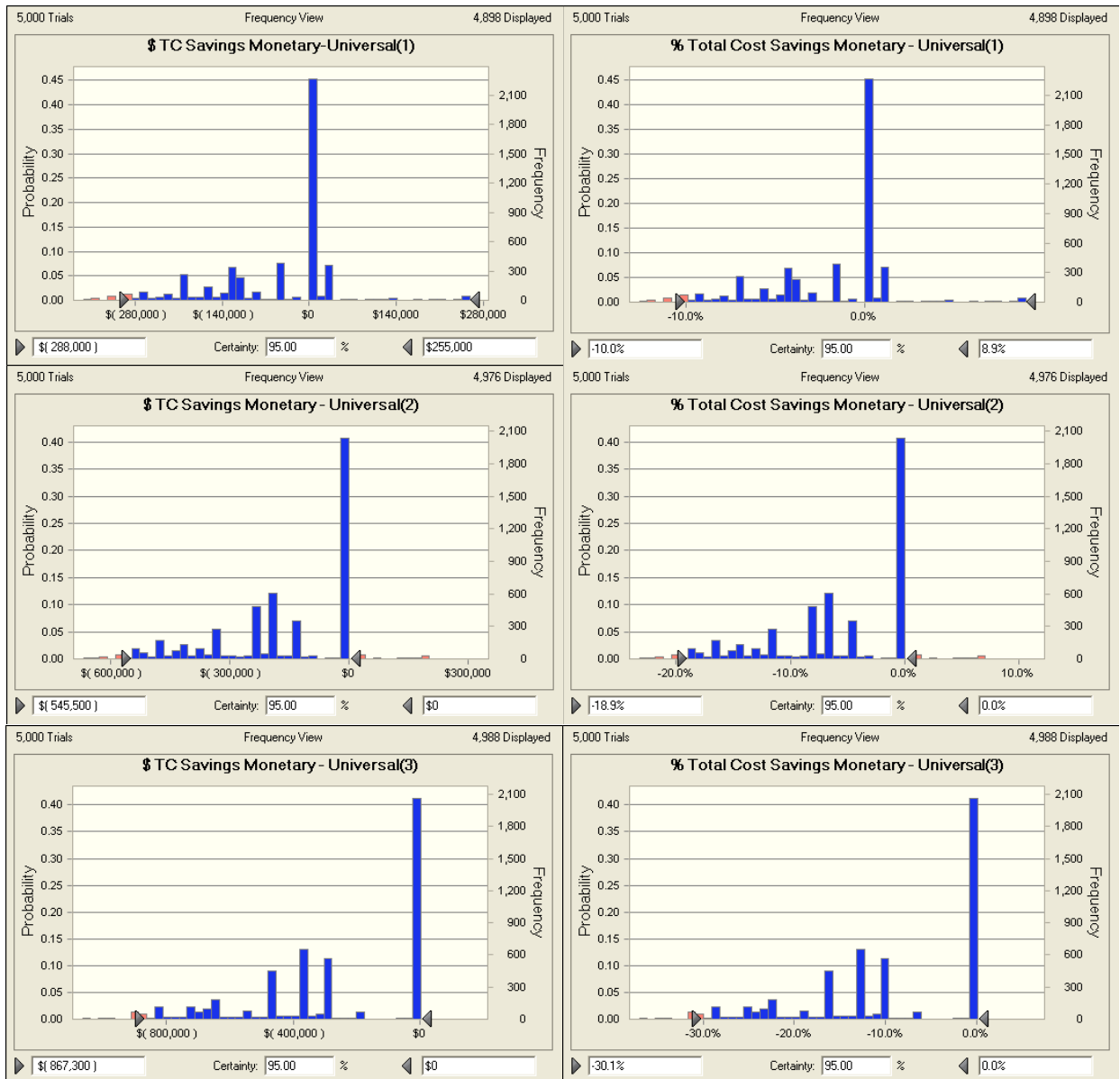


Figure 79. UIP Savings/Costs over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

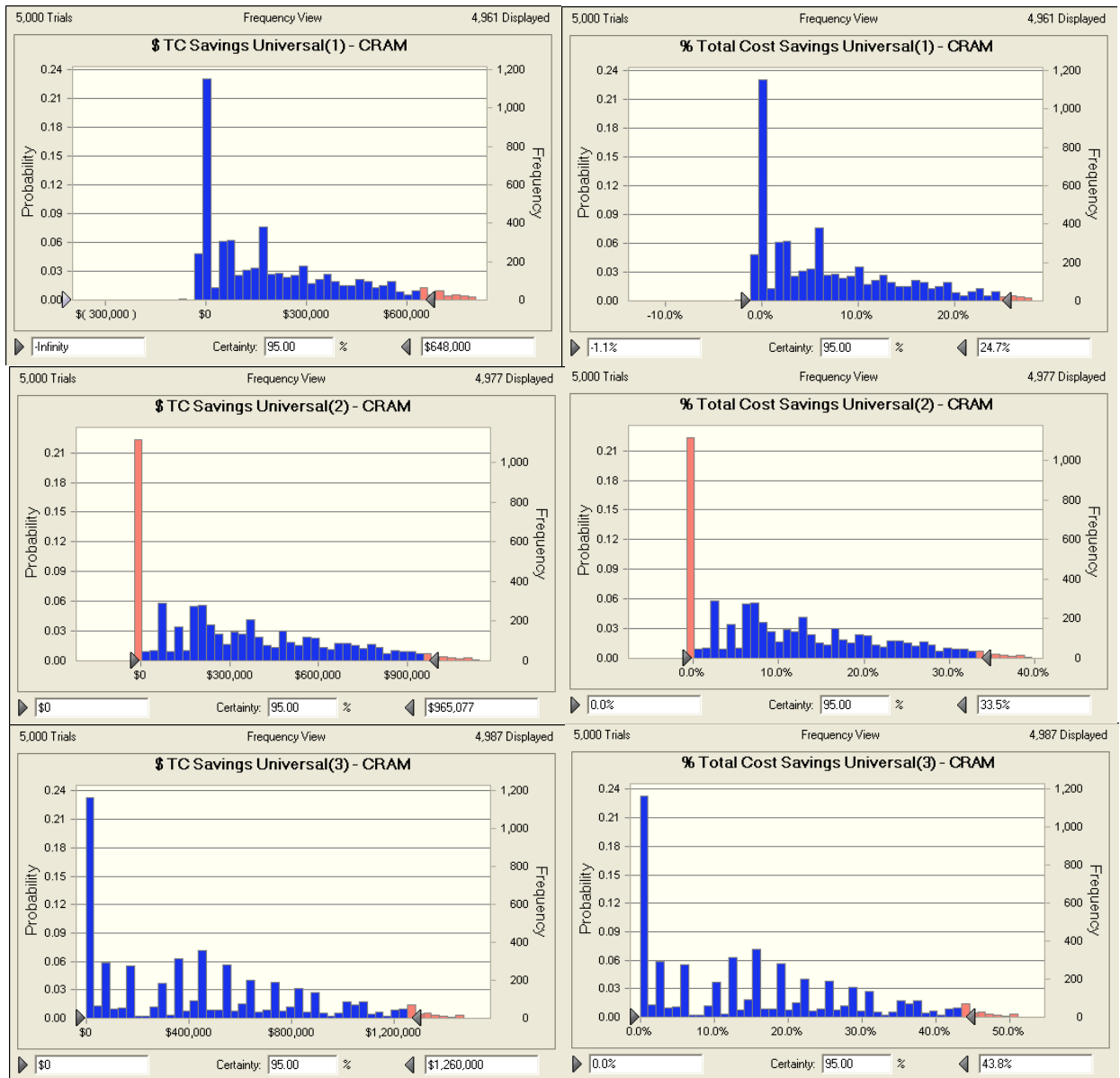


Figure 80. CRAM Savings over UIP
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

B. 50% Retention

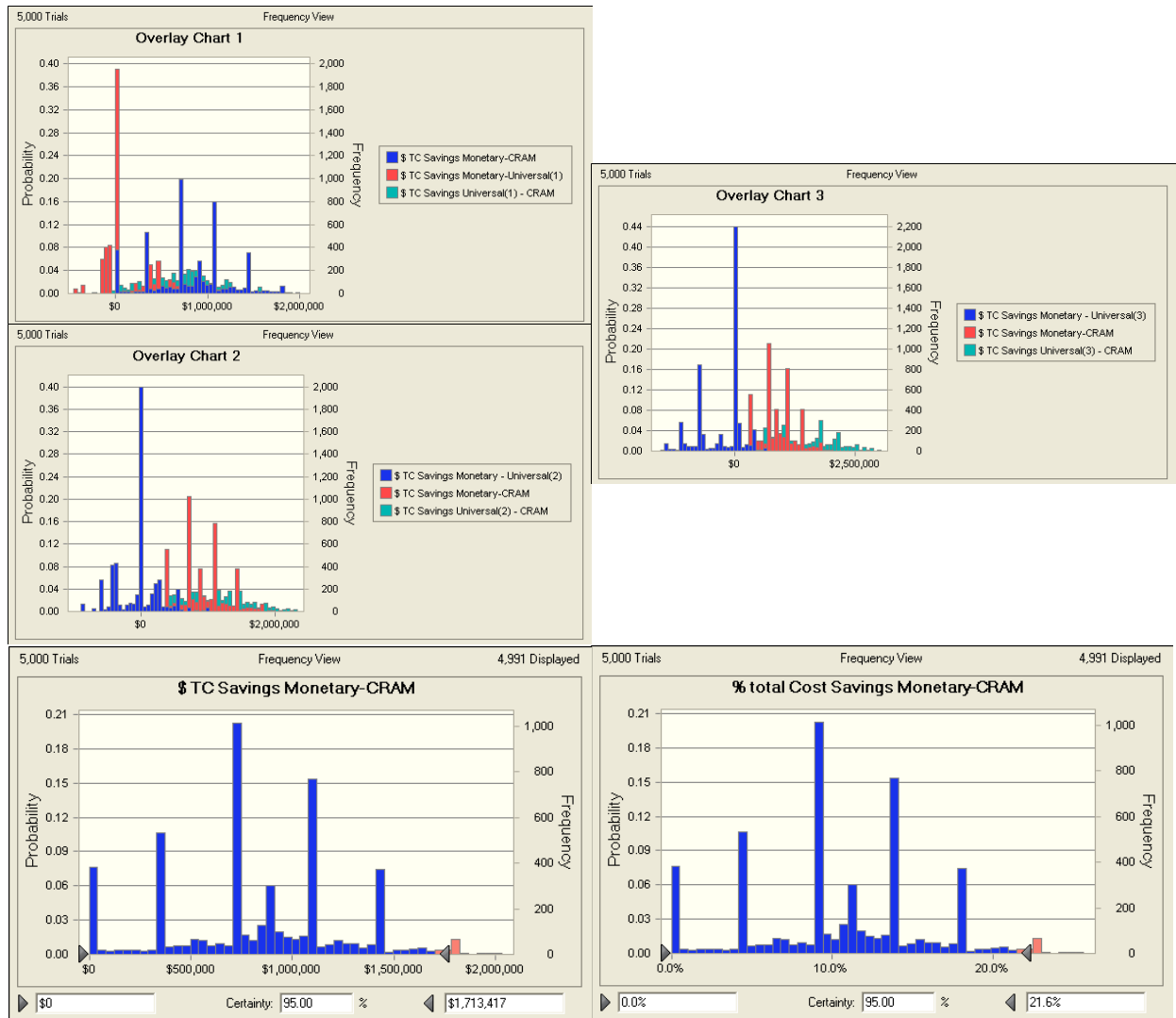


Figure 81. Overlay Charts and CRAM Savings over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

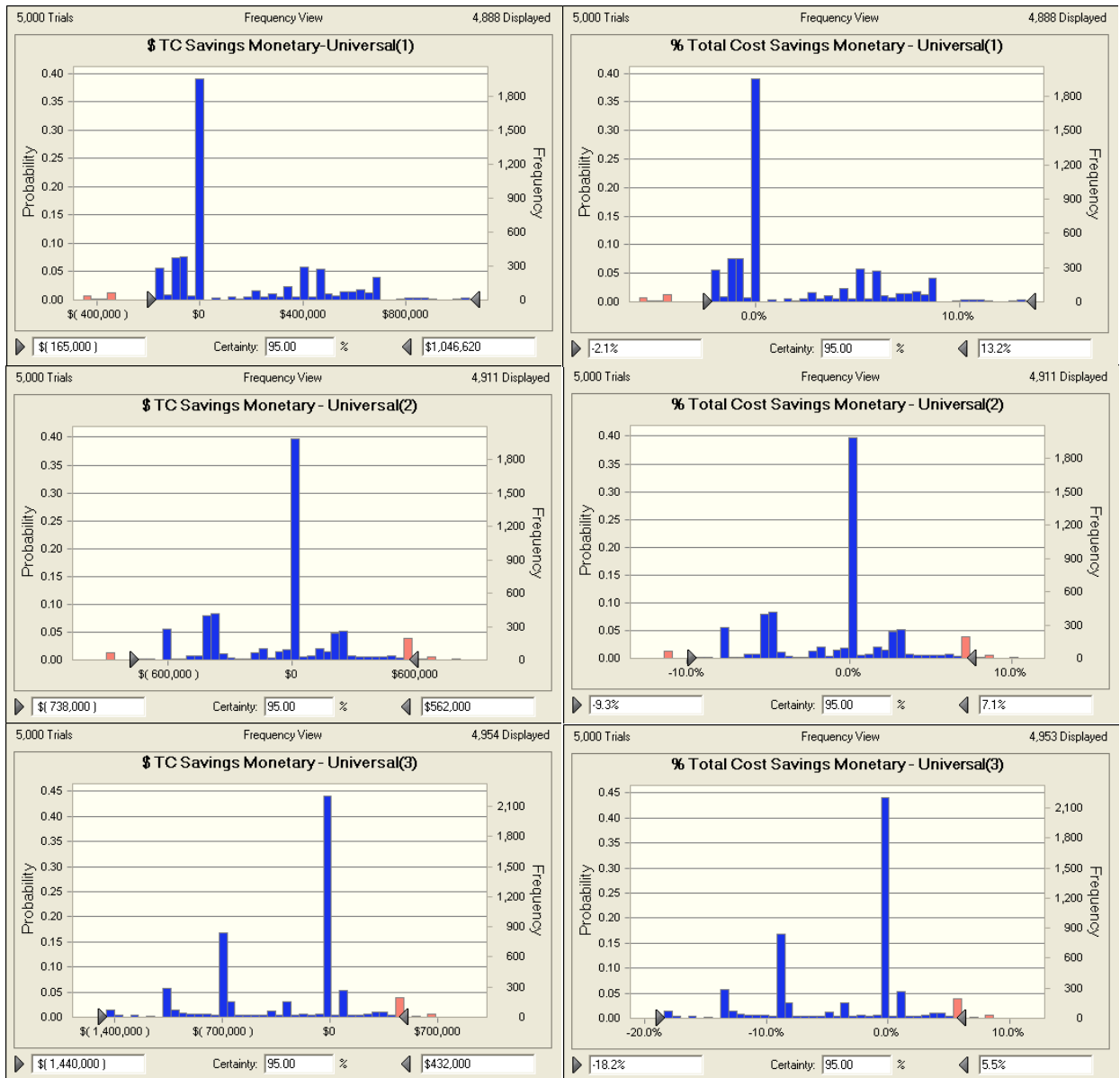


Figure 82. UIP Savings/Costs over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

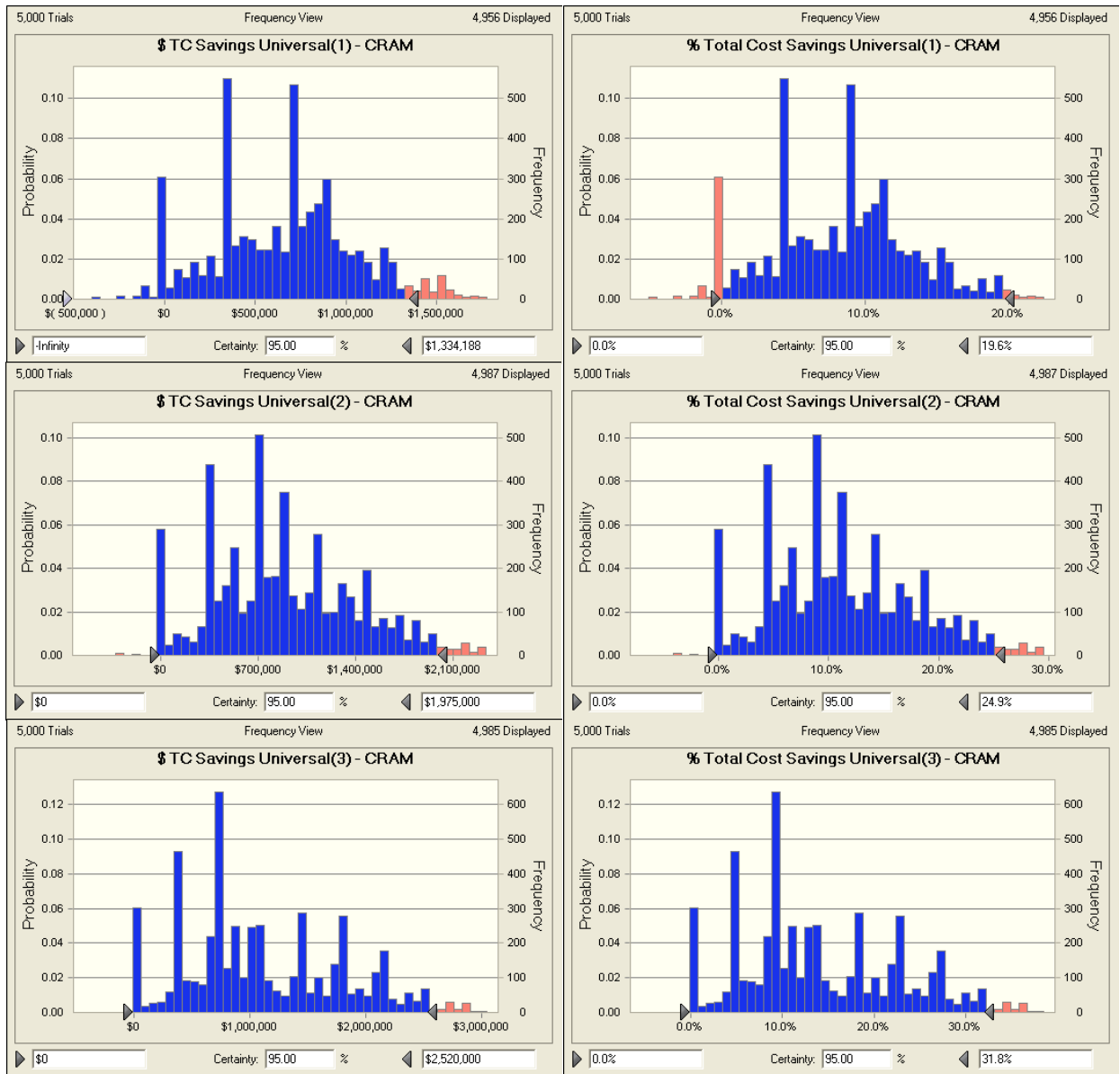


Figure 83. CRAM Savings over UIP
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

C. 75% Retention

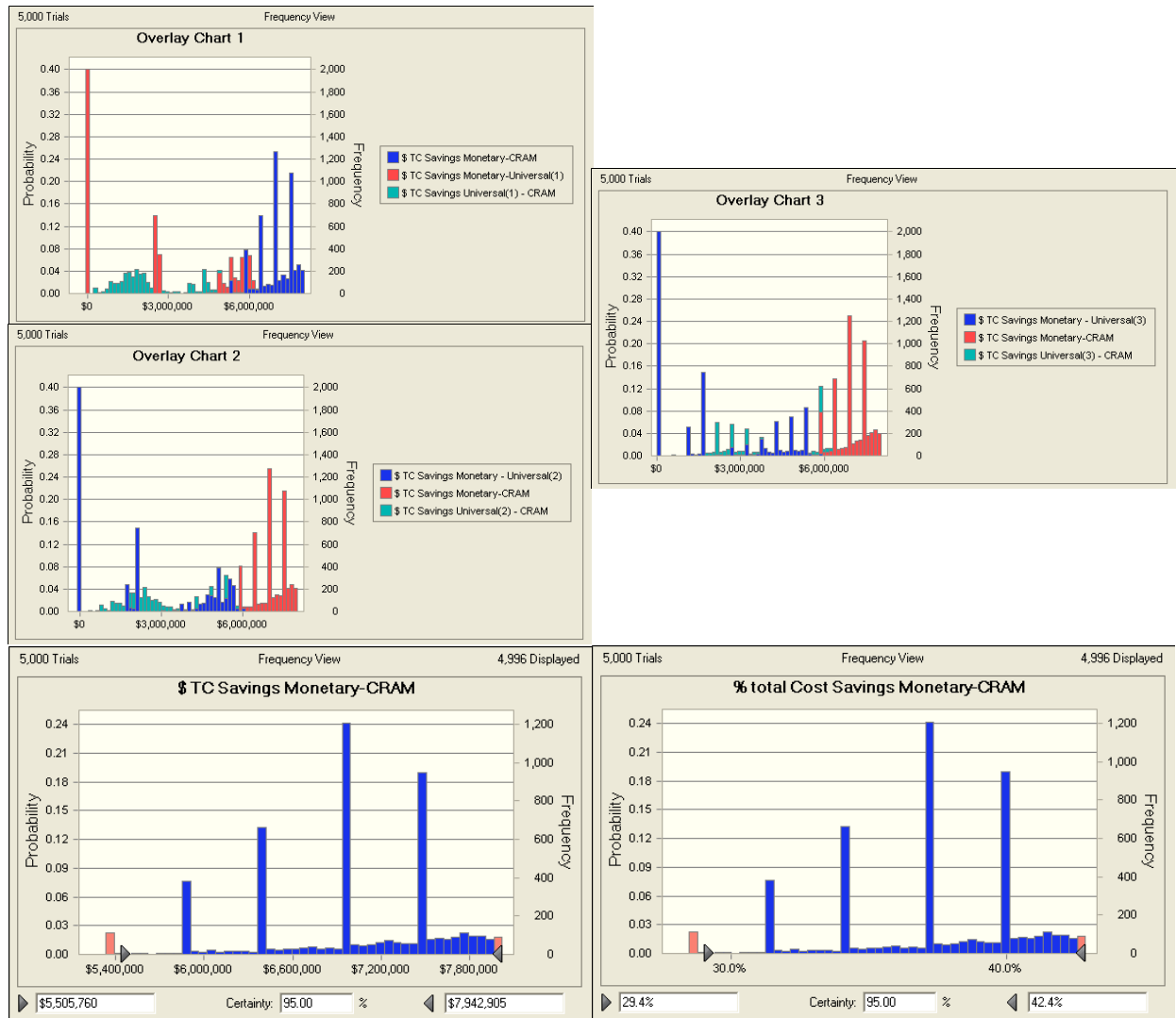


Figure 84. Overlay Charts and CRAM Savings over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

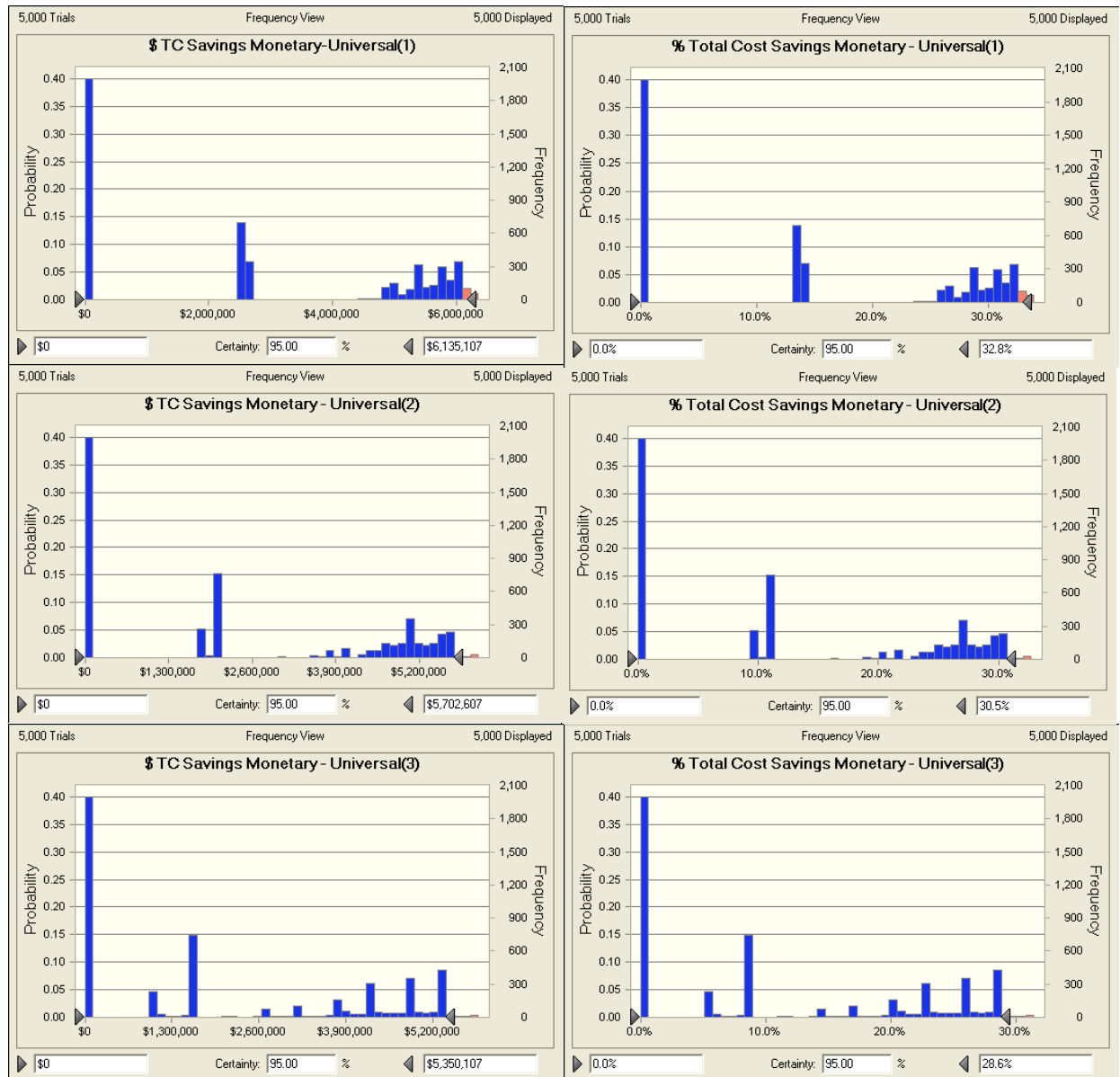


Figure 85. UIP Savings/Costs over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

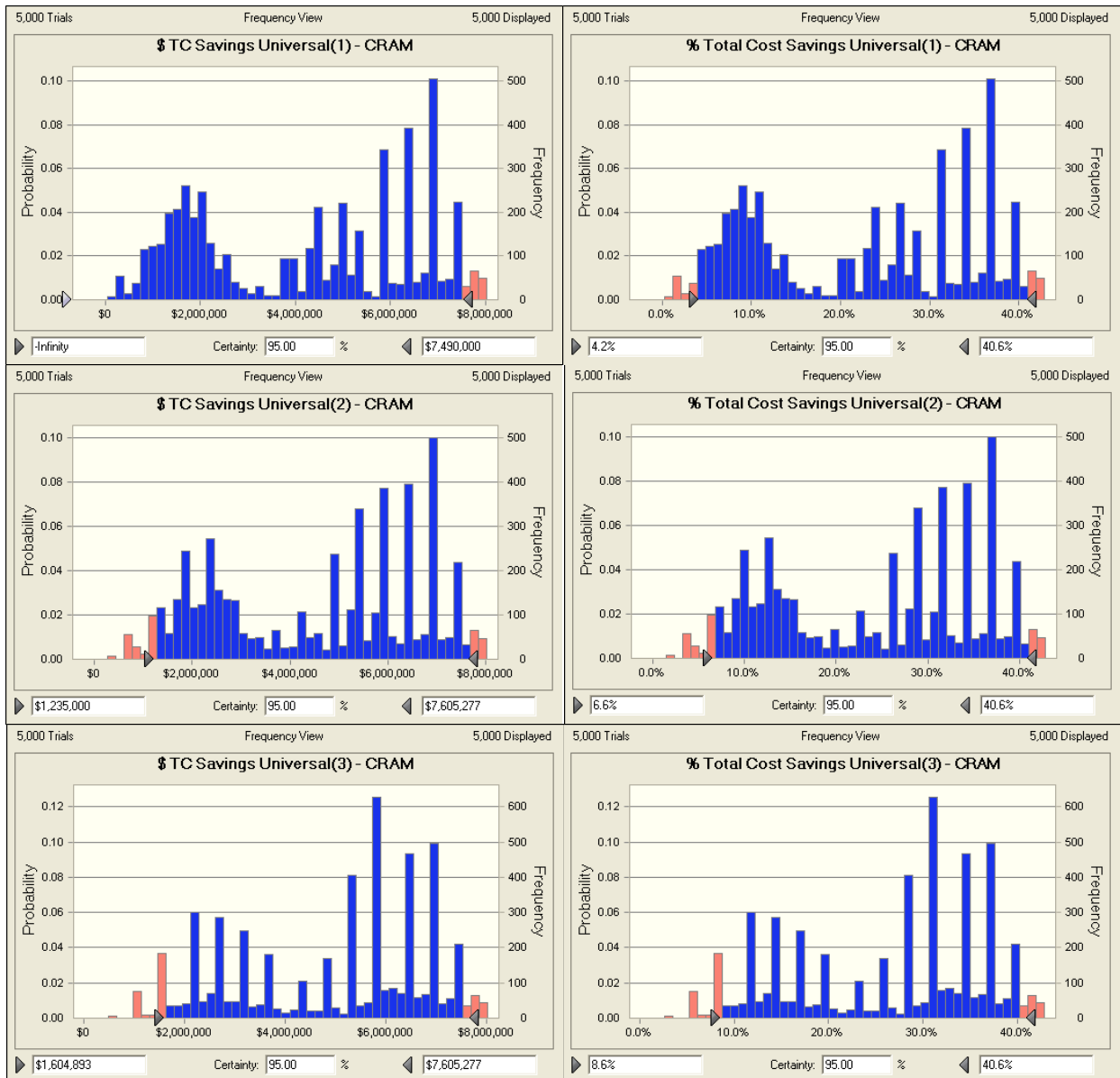


Figure 86. CRAM Savings over UIP
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

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Appendix G. Enlisted Varying Percentile Cost (High Positive) Simulation Results

A. 25% Retention

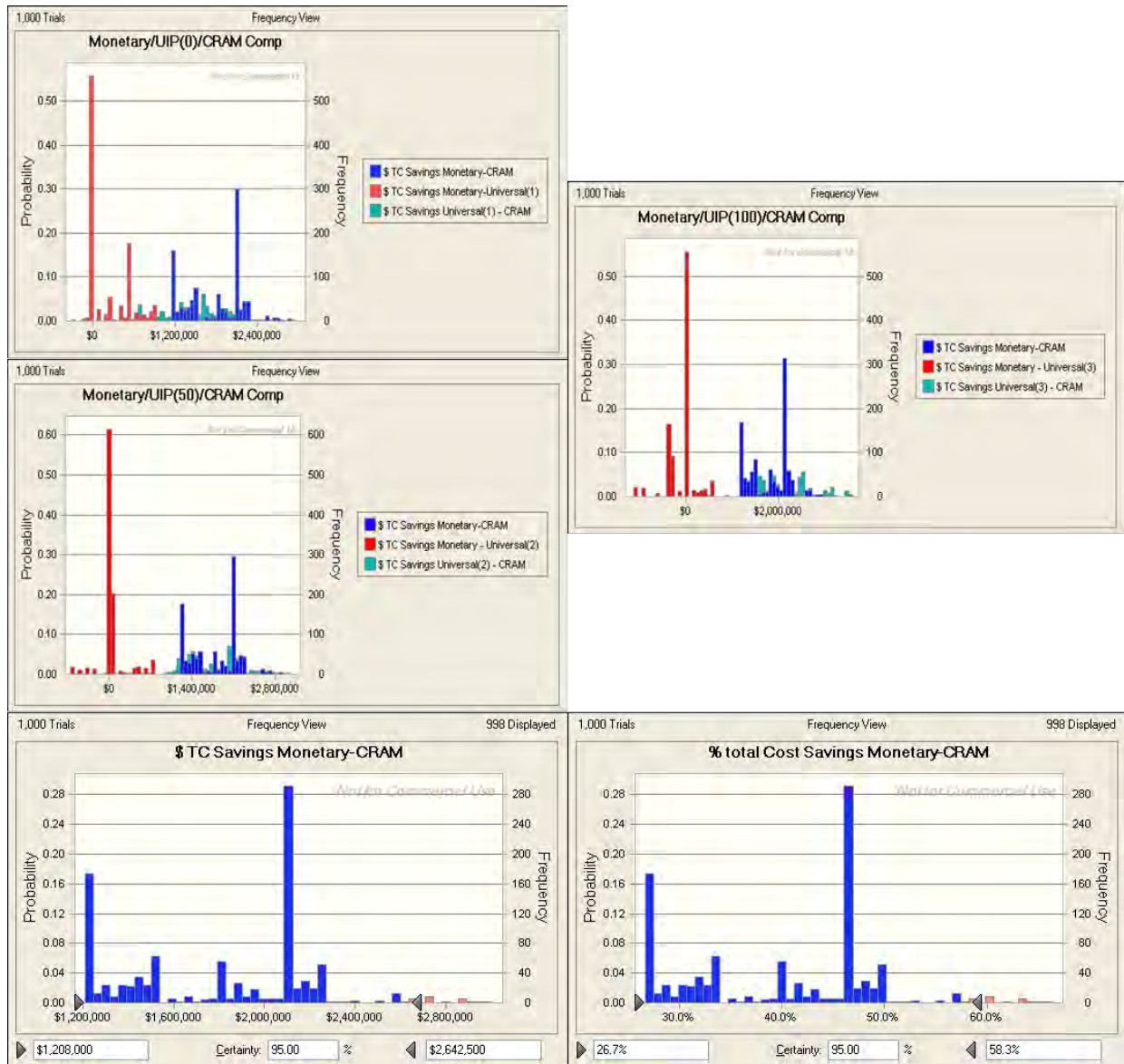


Figure 87. Overlay Charts and CRAM Savings over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

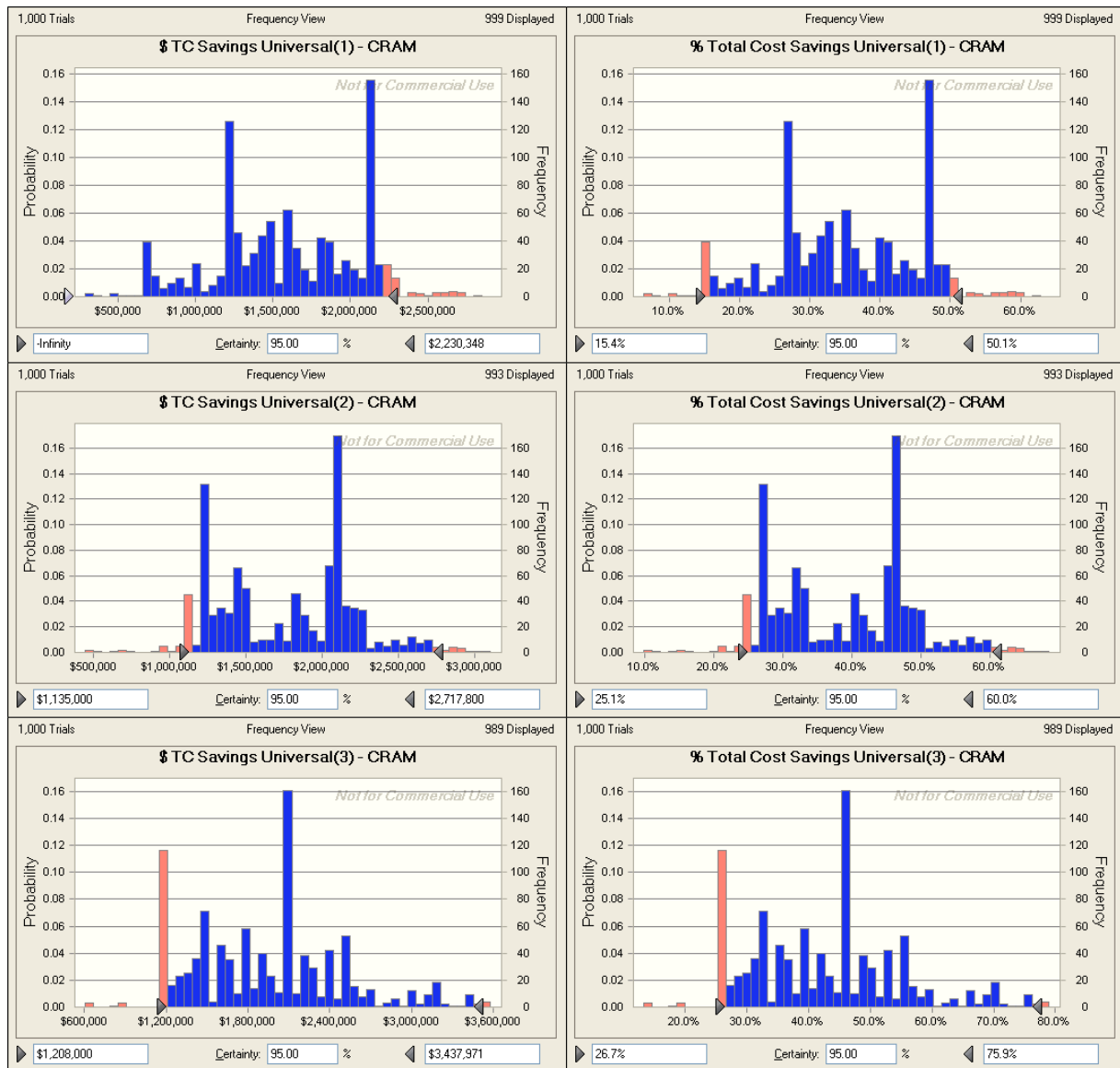


Figure 88. UIP Savings/Costs over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

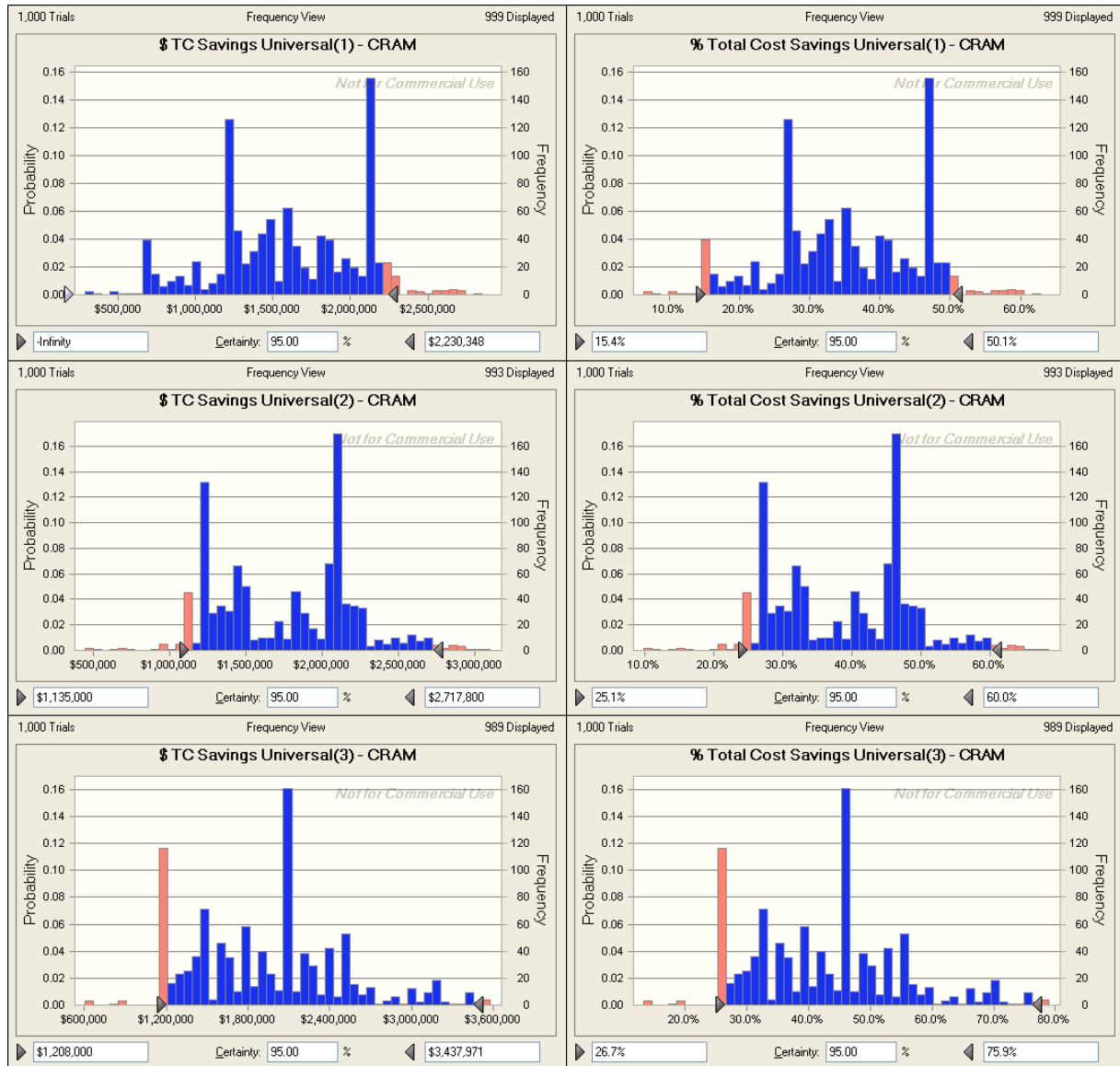


Figure 89. CRAM Savings over UIP
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

B. 50% Retention

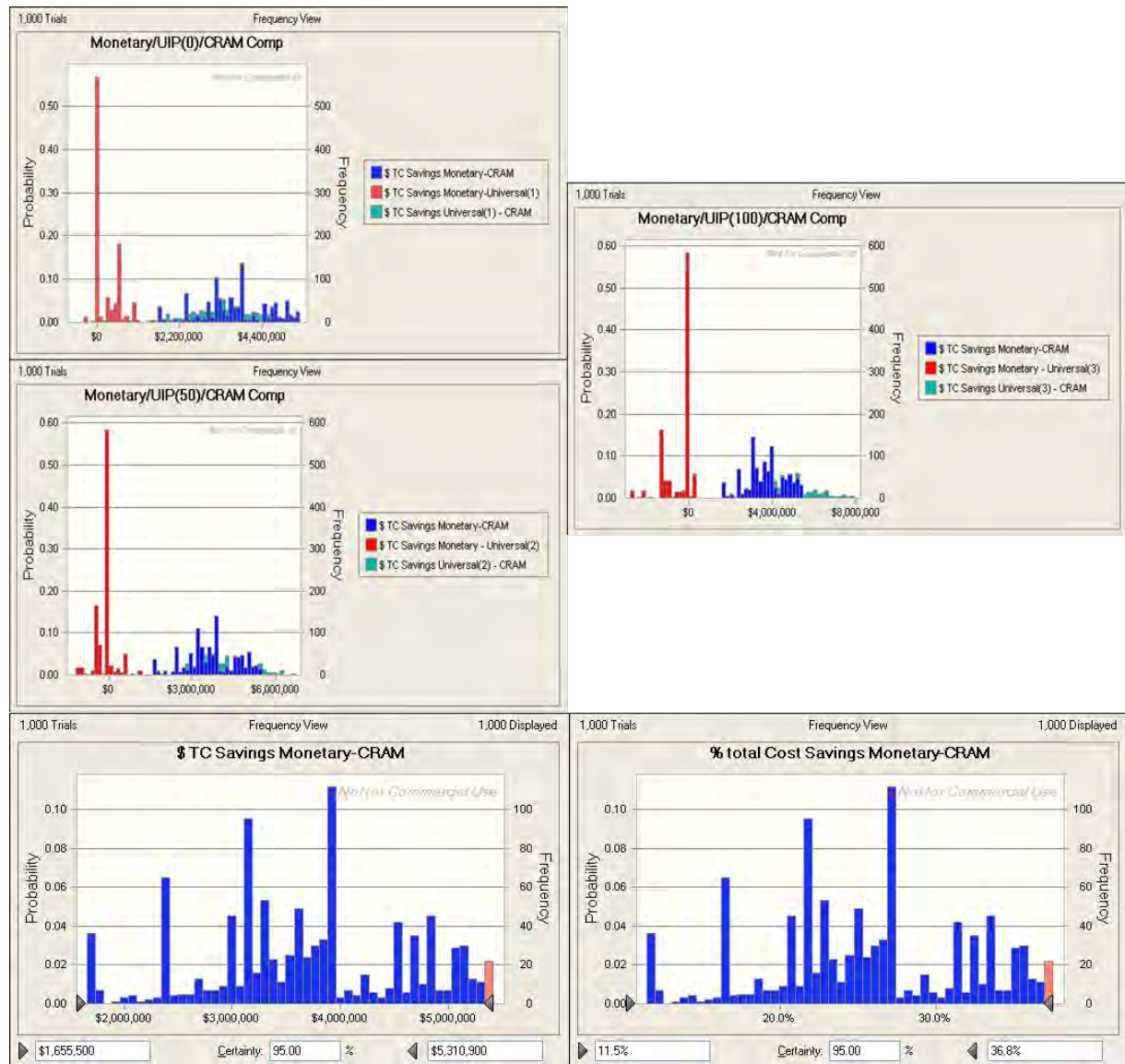


Figure 90. Overlay Charts and CRAM Savings over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

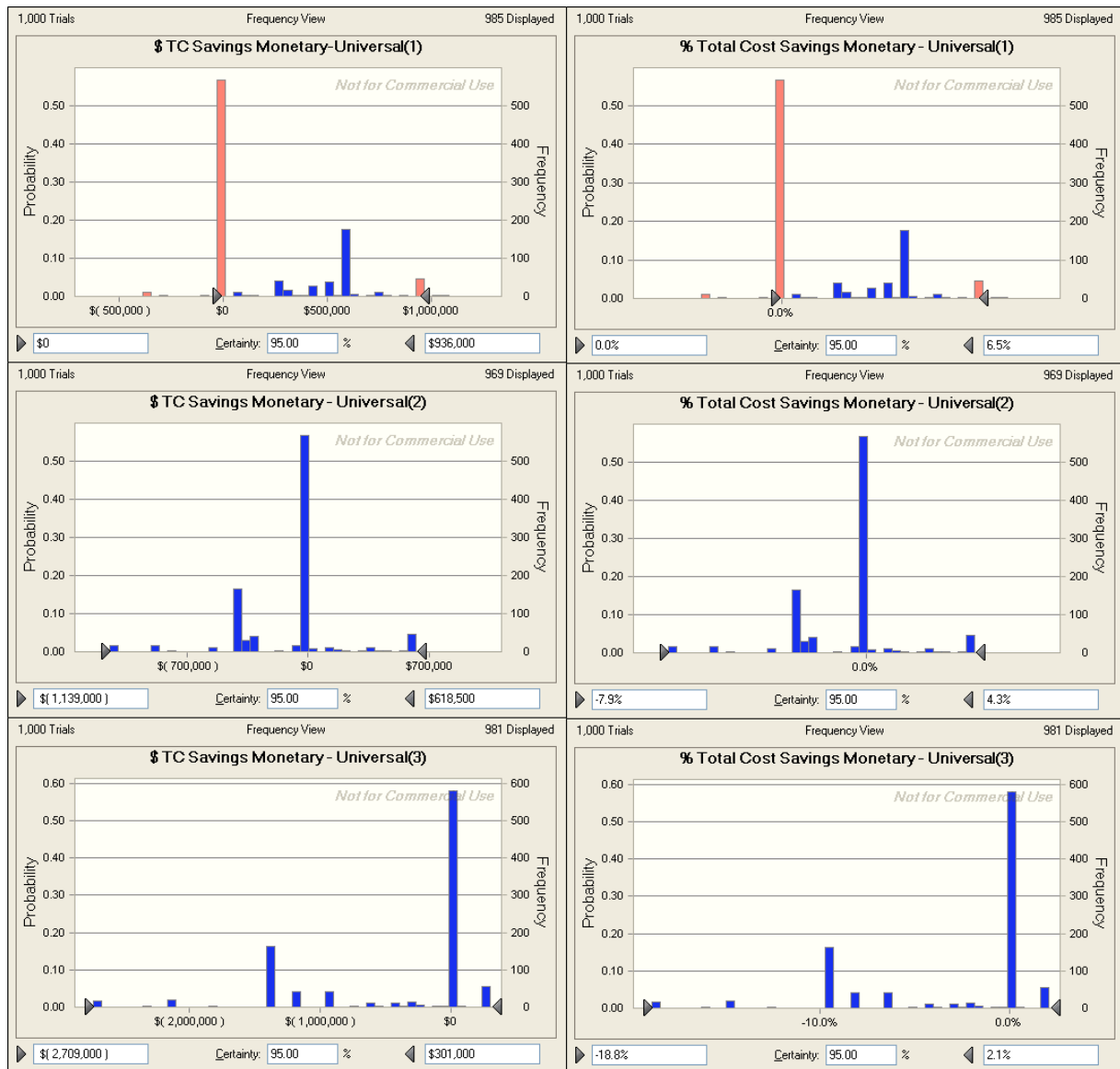


Figure 91. UIP Savings/Costs over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

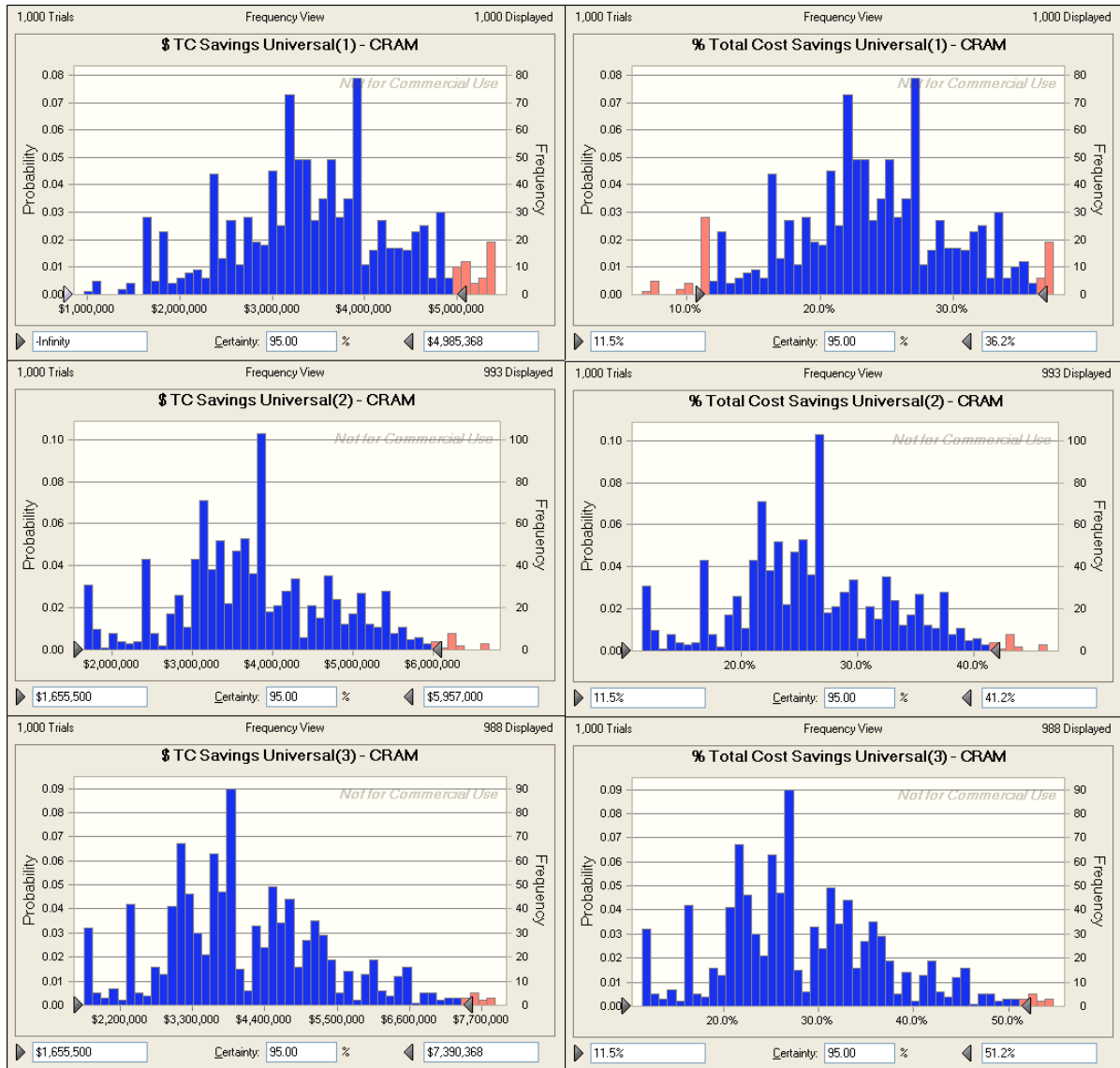


Figure 92. CRAM Savings over UIP
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

C. 75% Retention

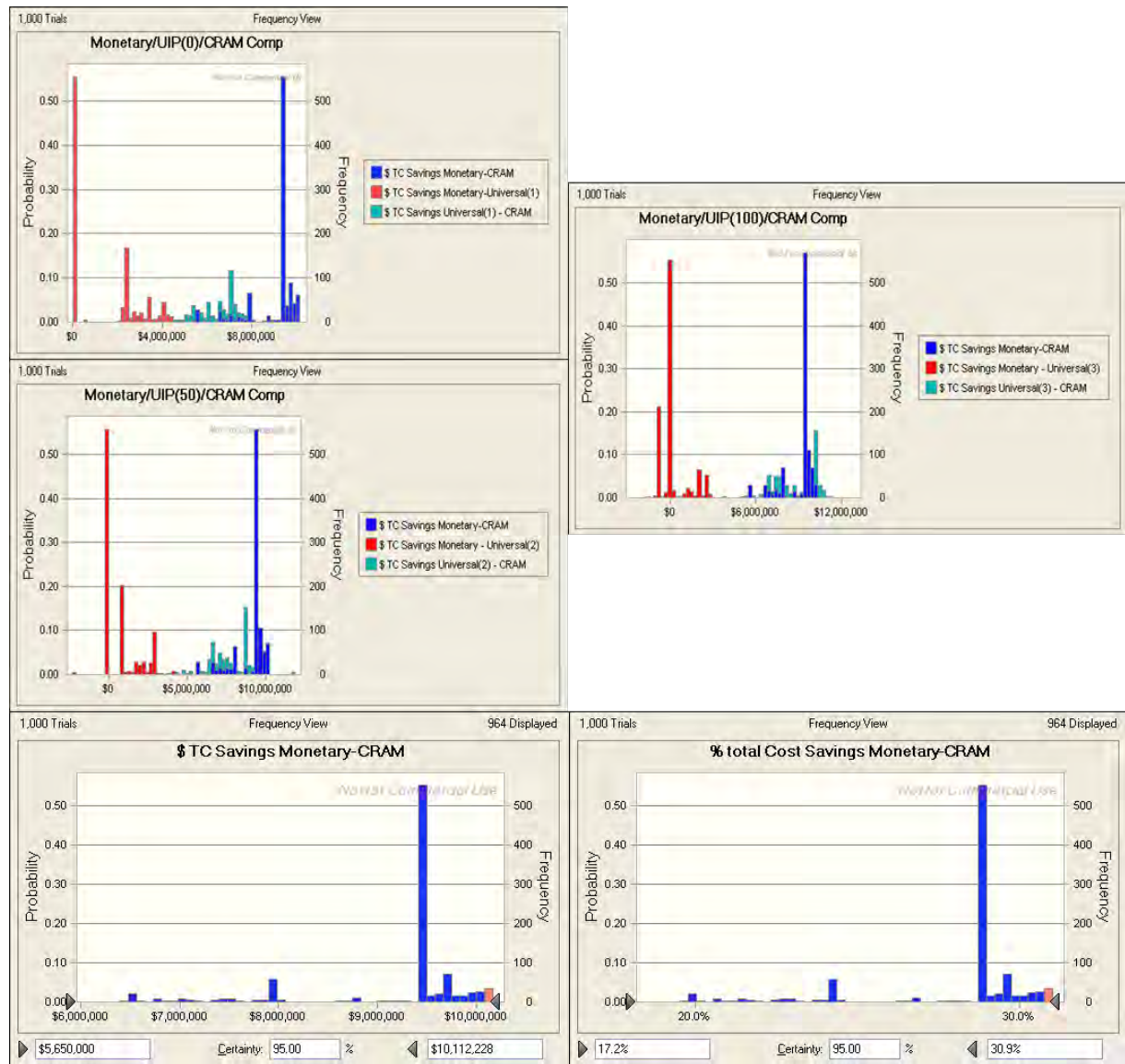


Figure 93. Overlay Charts and CRAM Savings over Monetary
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

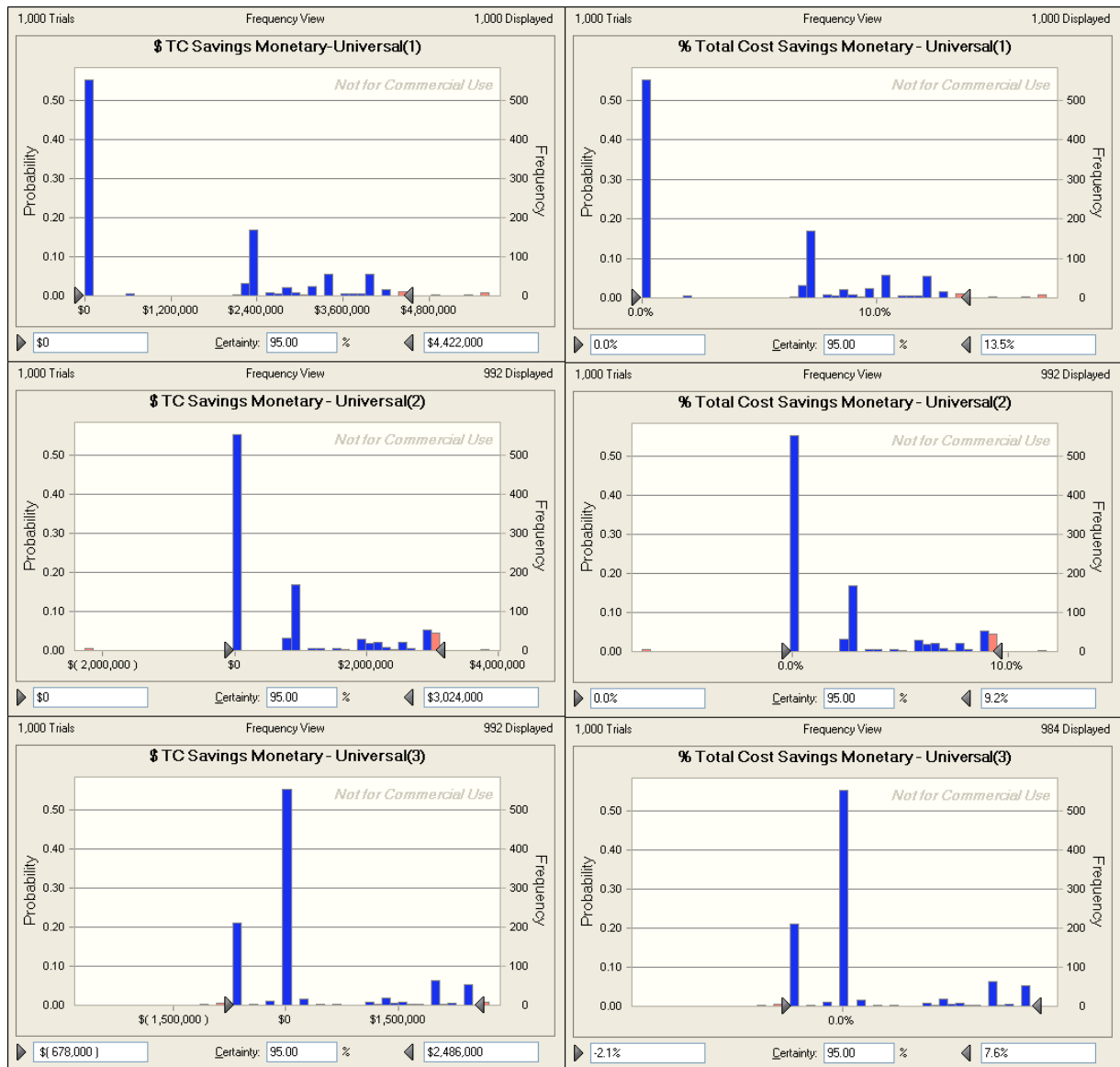


Figure 94. UIP Savings/Costs over Monetary
 Universal(1)=UIP(0);Universal(2)=UIP(50);Universal(3)=UIP(100)

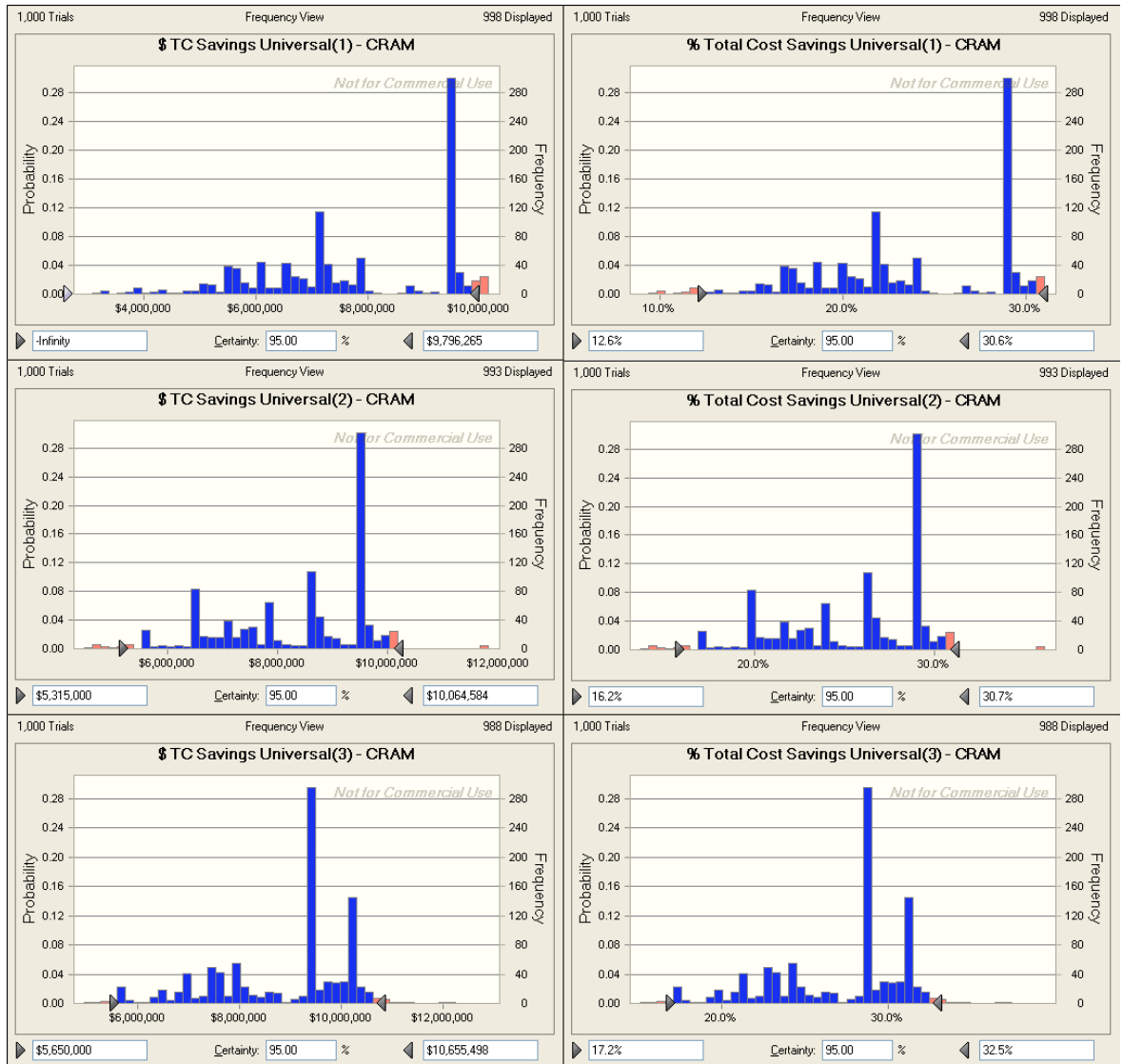


Figure 95. CRAM Savings over UIP
 Universal(1)=UIP(0); Universal(2)=UIP(50); Universal(3)=UIP(100)

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Appendix H. Diversity Charts

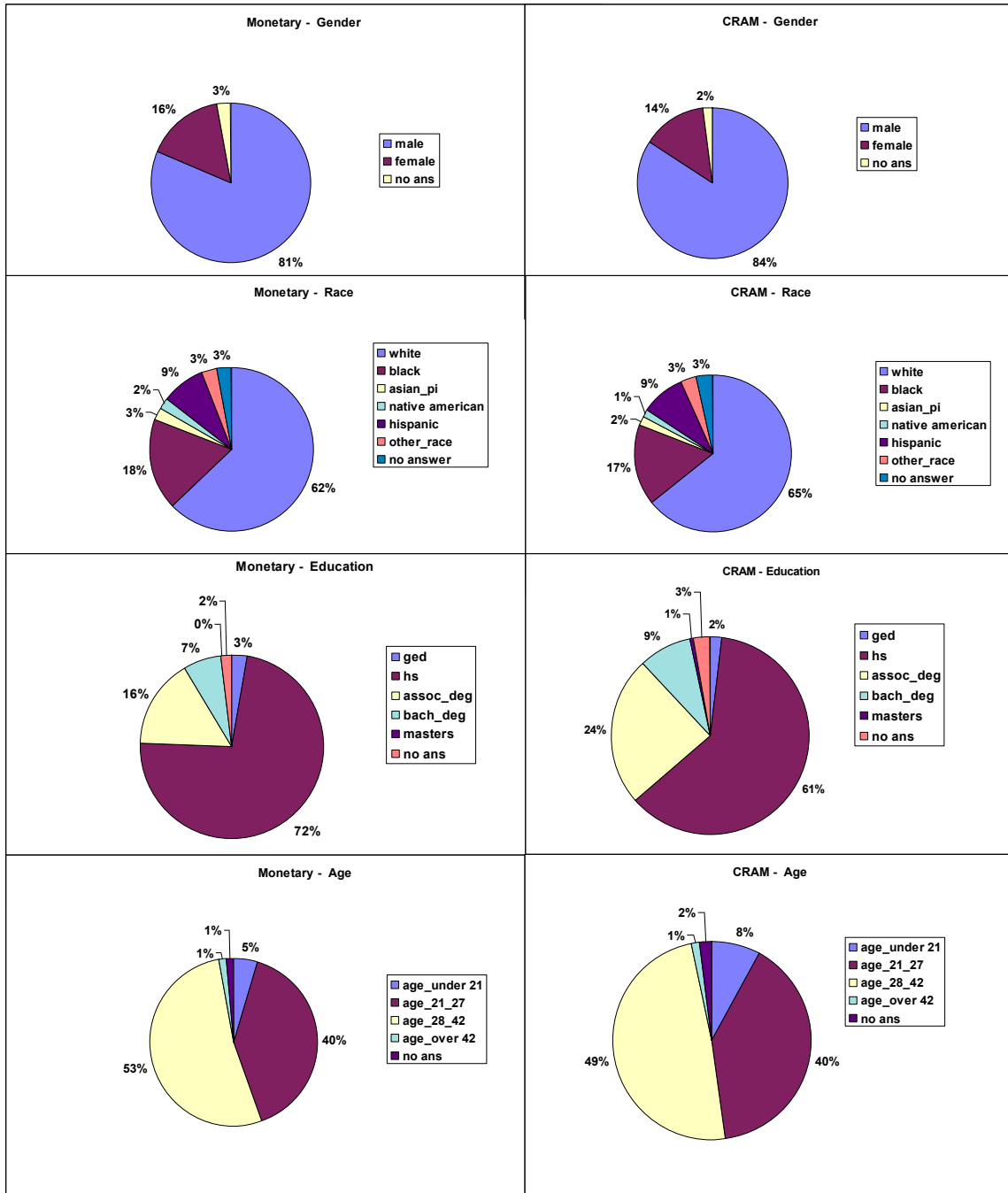


Figure 96. Base Case
All NMIs Offered

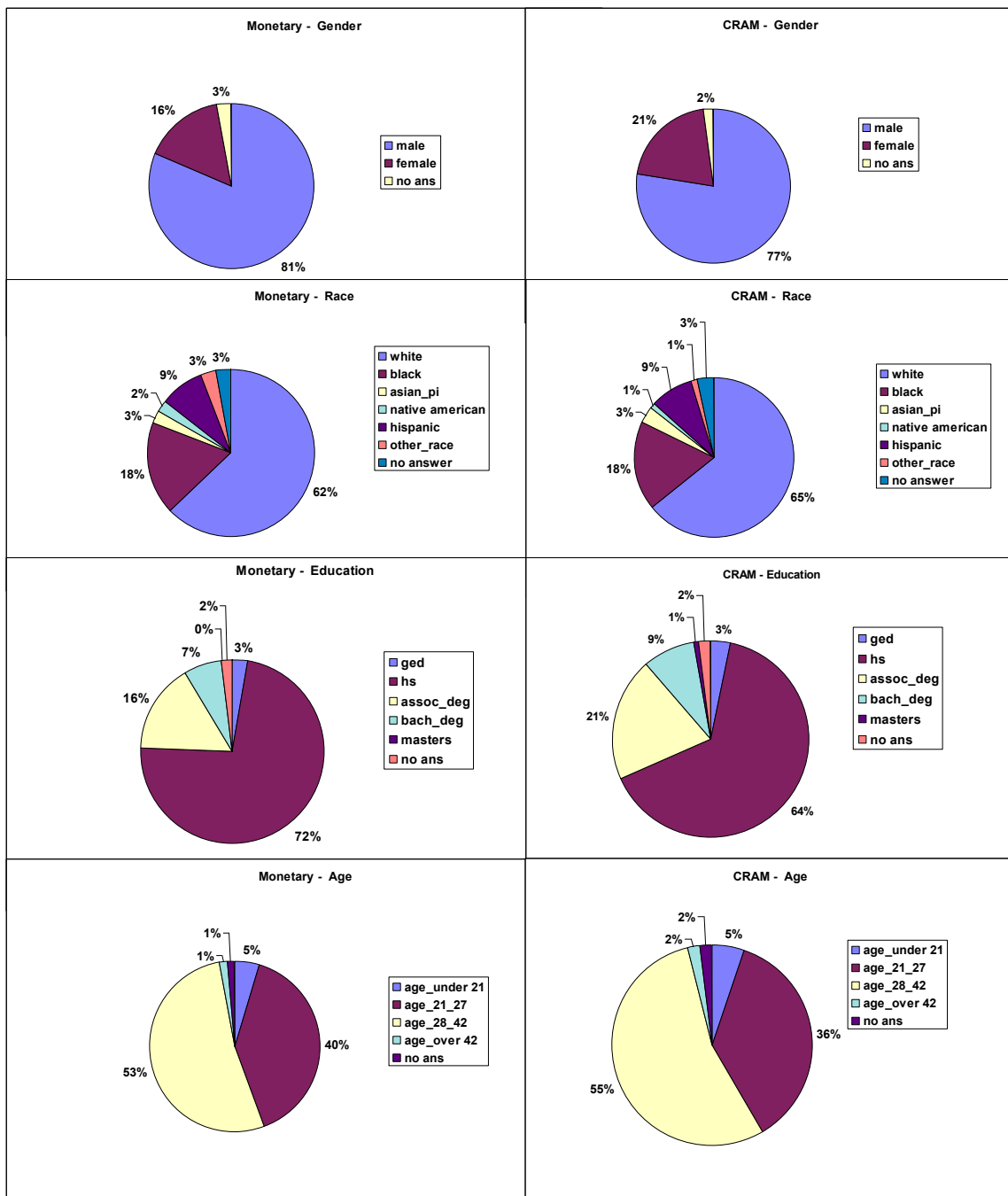


Figure 97. Maximum Increase in Female Representation
 NMIs Offered: Homeport and Billet.

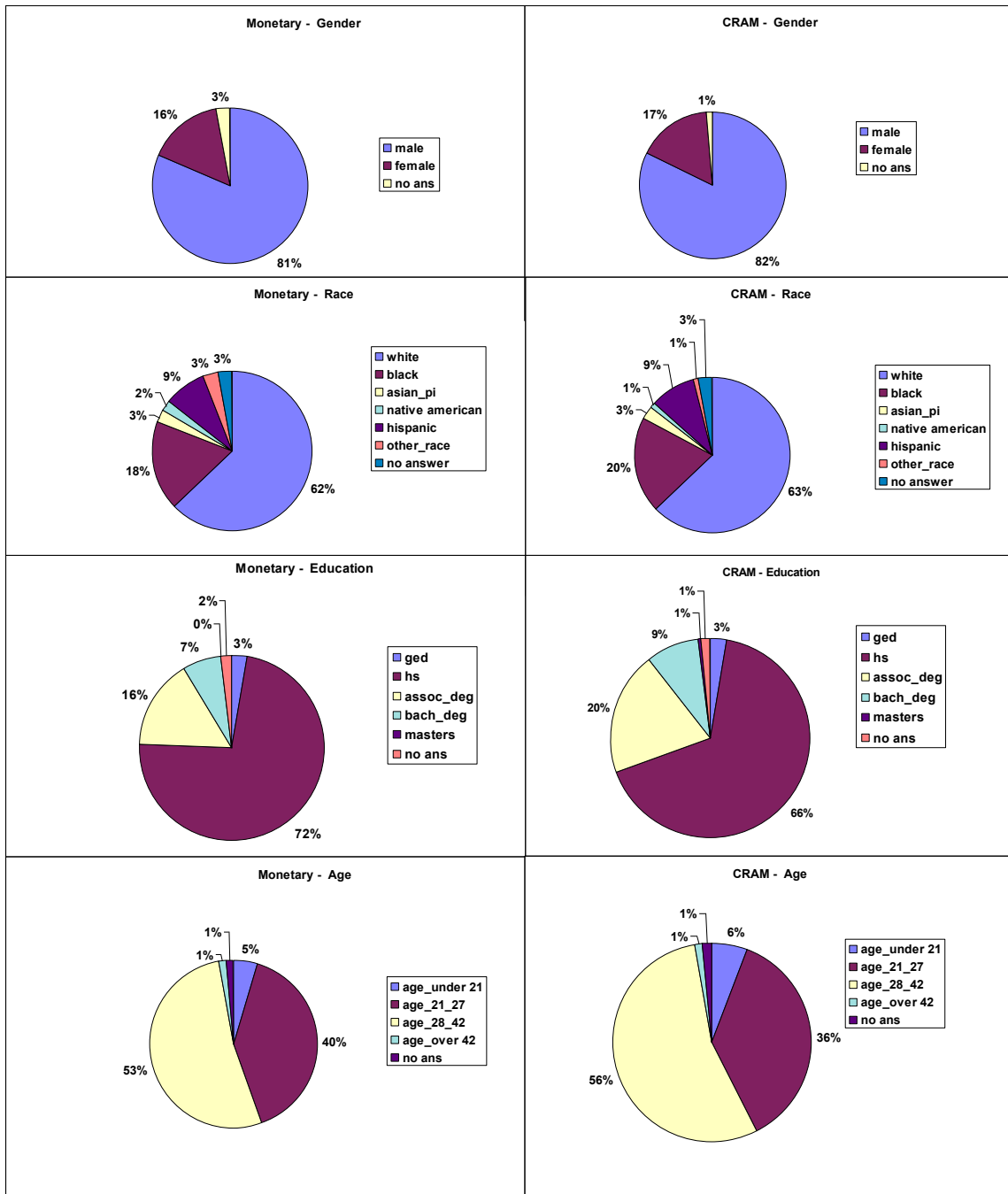


Figure 98. Maximum Increase in African-American (Black) Representation

NMIs Offered: Homeport, Compressed Work Week, Lump-sum SRB

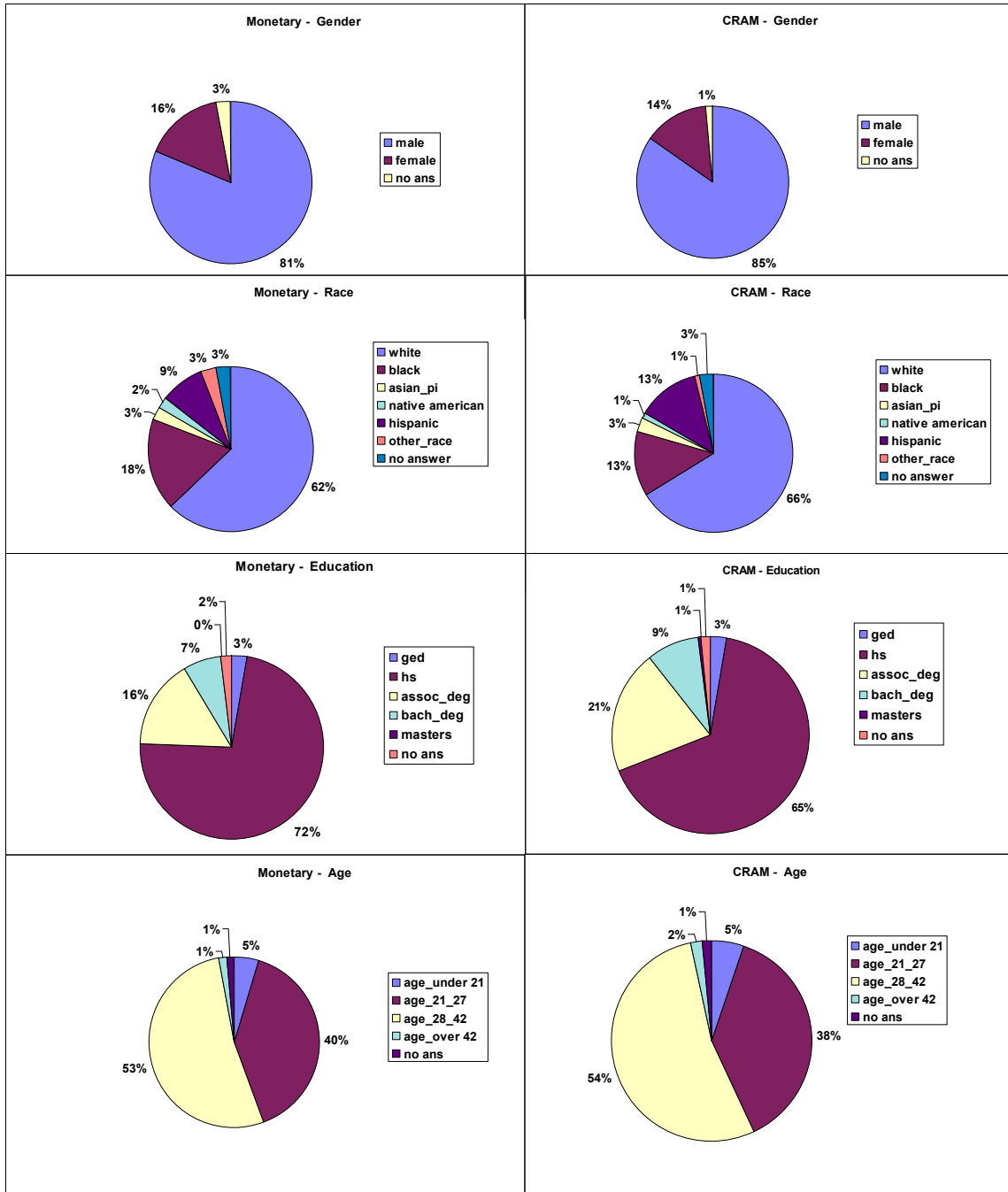
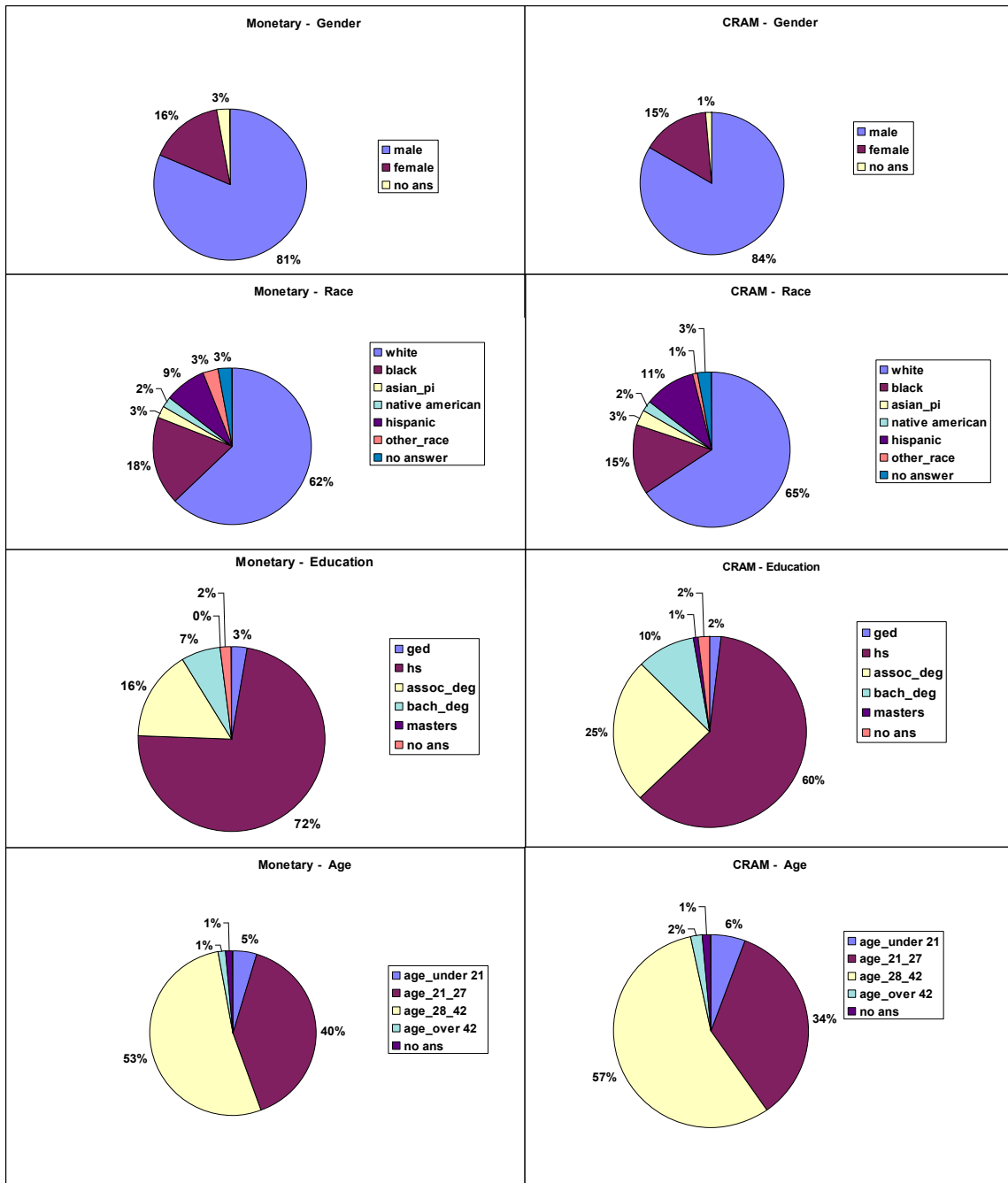


Figure 99. Maximum Increase in Hispanic Representation
 NMI's Offered: Platform, 2-tour Geographic Stability, Professional Certification, Lump-sum SRB



**Figure 100. Maximum Increase in Education Representation:
At or above Associate's Degree**
NMI's Offered: Homeport, Platform, Sabbatical, Telecommuting,
Compressed Week, Barracks Room at Sea, Lump-sum SRB

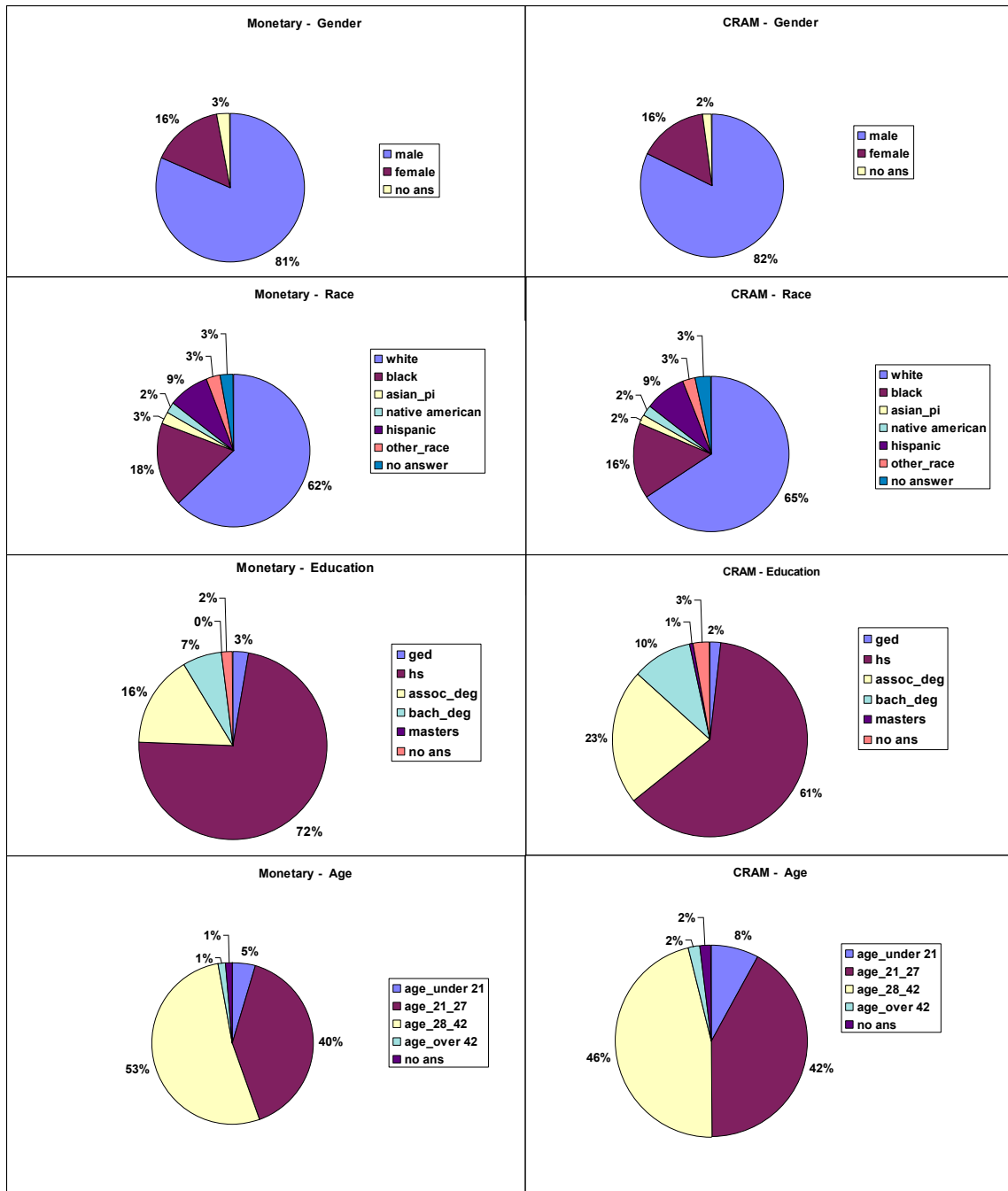


Figure 101. Maximum Increase in Generation Y Representation
 NMIs Offered: Platform, Billet, Sabbatical, Telecommuting, 3-tour Geographic Stability, Professional Certification, Compressed Week, Barracks Room at sea, Lump-sum SRB

Initial Distribution List

1. Defense Technical Information Center 2
8725 John J. Kingman Rd., STE 0944; Ft. Belvoir, VA 22060-6218
2. Dudley Knox Library, Code 013 2
Naval Postgraduate School, Monterey, CA 93943-5100
3. Research Office, Code 09 1
Naval Postgraduate School, Monterey, CA 93943-5138
4. Bill Gates 1
Dean, GSBPP
E-mail: bgates@nps.edu
5. Pete Coughlan 1
Associate Professor
E-mail pjcoughl@nps.edu

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